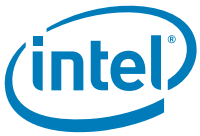

Intel® Server Chassis SR2500

Intel® Server System SR2500AL

Technical Product Specification

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Enterprise Platforms and Services Division - Marketing

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Date	Revision Number	Modifications
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1. Product Overview

The Intel® Server Chassis SR2500 is a 2U server chassis that is designed to support the Intel® Server Board S5000PAL. The server board and the chassis have features that are designed to support the high-density server market. This chapter provides a high-level overview of the chassis features. Greater detail for each major chassis component or feature is provided in the following chapters.

The chassis differs from previous generation products in that the majority of cables have been removed from the system and in their place are a series of board-to-board interconnects. The benefits of using board-to-board interconnects are simplification of platform integration and improved airflow for more reliable cooling.

A second significant change from the previous generation is the introduction of the mid-plane circuit board. There are two options for the mid-plane circuit board: the first option provides SAS RAID support. The second option is a passive SATA/SAS mid-plane that can be used with either the SATA only connectors from the server board, or SATA/SAS connectors from an add-in card.

1.1 Chassis Views

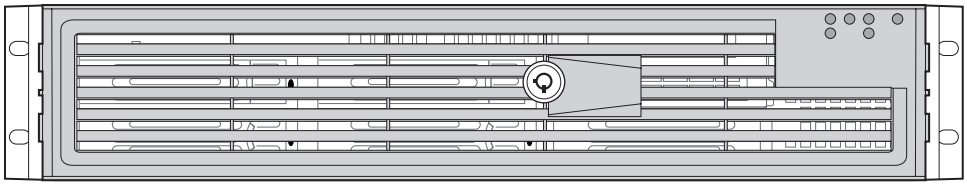


Figure 1. Front View with Optional Bezel

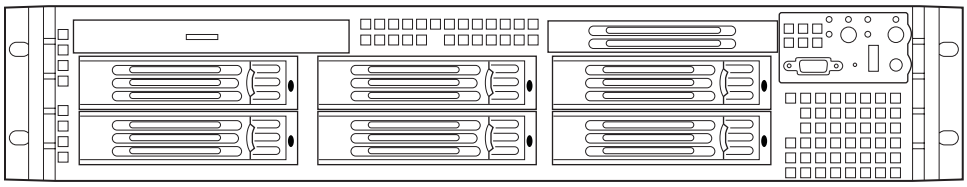


Figure 2. Front View without Bezel (Shown with Standard Control Panel Option)

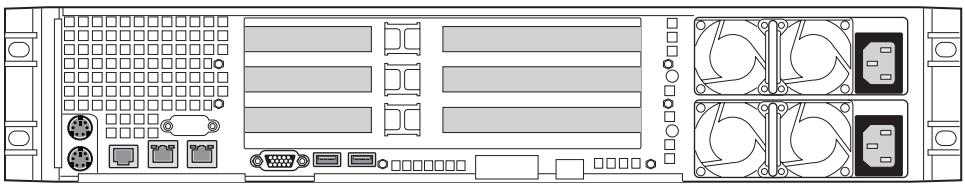


Figure 3. Back View – (Shown with 1+1 Power Supply Configuration)

1.2 Chassis Dimensions

Table 1. Chassis Dimensions

Height	87.30 mm	3.44”
Width without rails	430 mm	16.93”
Width with rails	451.3 mm	17.77”
Depth without CMA	704.8 mm	27.75”
Depth with CMA	838.2 mm	33.0”
Max. Weight	29.5 kg	65 lbs

1.3 System Components

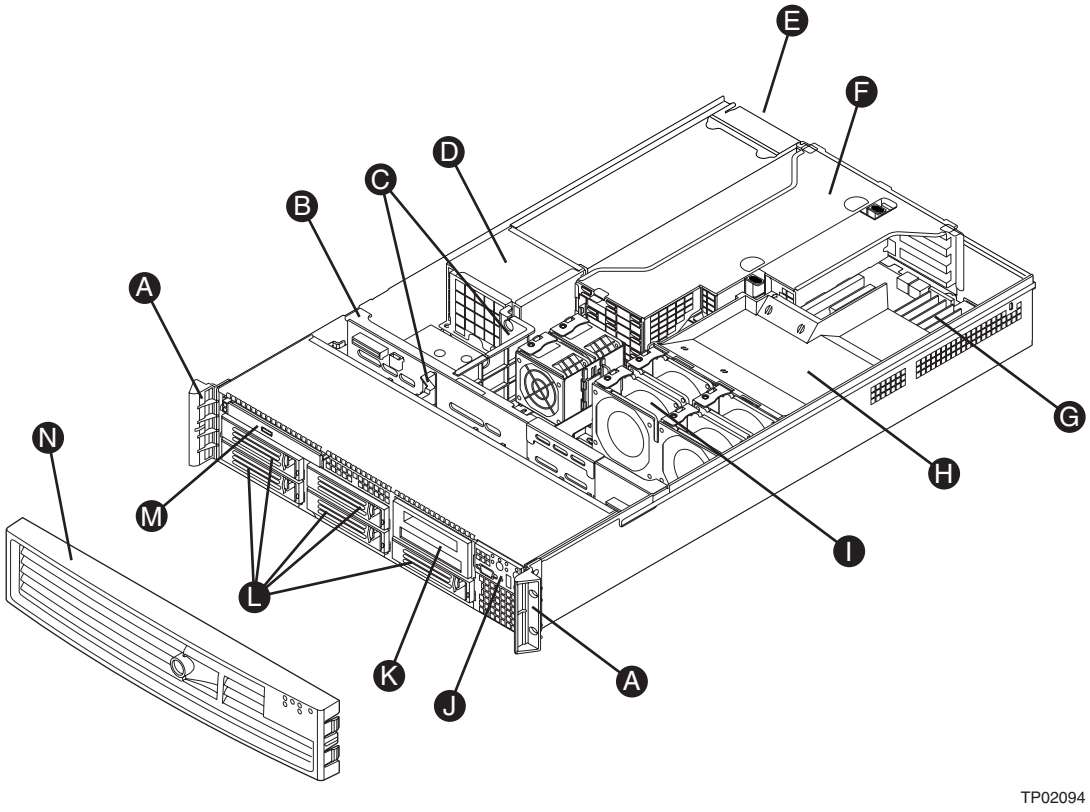


Figure 4. Major Chassis Components

A. Rack Handles
B. SAS/SATA Backplane
C. Air Baffles
D. Power Distribution Module
E. Power Supply Modules
F. Riser Card Assembly
G. System Memory
H. CPU Air Duct
I. System Fan Assembly
J. Standard Control Panel
K. Flex Bay – 6th HDD or Tape (Optional)
L. Hard Drive Bays
M. Slim-Line Optical Drive Bay
N. Front Bezel (Optional)

The I/O connector locations on the back of the chassis are pre-cut, so the use of an I/O shield is not required. The supplied EMI gasket must be installed to maintain Electromagnetic Interference (EMI) compliance levels.

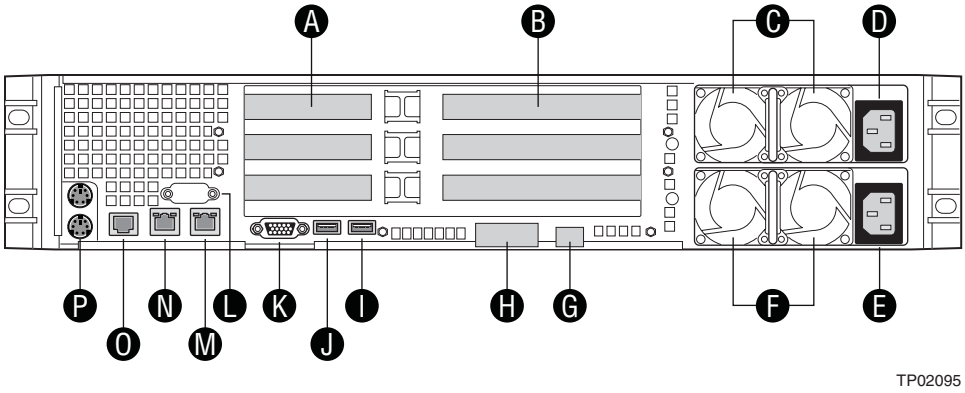


Figure 5. Back Panel Feature Overview

A.	Low Profile PCIe* Add-in Card Slots	I.	USB 6
B.	Full Height PCI Add-in Card Slots	J.	USB 5
C.	Upper Power Supply Module	K.	Video
D.	Upper Power Receptacle	L.	DB-9 Serial A Connector
E.	Lower Power Receptacle	M.	NIC 2
F.	Lower Power supply Module	N.	NIC 1
G.	Intel® Remote Management Module NIC (Optional)	O.	RJ45 Serial B Connector
H.	Intel® I/O Expansion Module (Optional)	P.	PS2* Keyboard and Mouse Connectors

1.4 System Boards

The complete system includes the use of several system boards which are used as internal interconnects and provide feature accessibility. The following provides a brief description for each.

- Bridge Board – PCB used to route signals from the server board to the mid-plane and control panel boards.
- Mid-plane – A PCB used to determine the desired hard drive interface for the system. Two mid-plane options are available for this system:
  - Active SAS/SAS RAID – cable less solution with onboard SAS controller
  - Passive SATA – cabled to SATA ports on the server board or from add-in adapter.
- Backplane – Hot swap backplane capable of supporting both SATA and SAS hard drives.
- Riser Cards – PCI riser cards used to provide up to five add-in card slots to the system. Available riser card options for this system include:
  - Low profile, two slot PCI Express*
  - Full height, three slot PCI-X* (passive)
  - Full height, three slot PCI-X (active) with onboard PXH PCI bridge chip
  - Full height, two PCI Express slots + one PCI-X slot

- Optical Drive Interposer Card – Used to interface optical drive with 44-pin IDE cable as cabled from the server board.
- Control Panel – A PCB providing system status and control functionality features. Two control panel options are available for this system
    - Standard Control Panel
    - Intel® Local Control Panel with LCD support
- RAID Activation Keys – The system provides different RAID options depending on the mid-plane option selected. Two RAID Activation Keys are available for this system
    - Hardware RAID Activation Key – Used on the Active SAS/SAS RAID Mid-plane to enable hardware RAID support.
    - Software SATA RAID 5 Activation Key – This RAID key plugs into a connector on the server board. It is used to enable the software SATA RAID 5 functionality of the Intel® 6321ESB I/O Controller Hub SATA ports of the server board when cabled to the passive mid-plane.

1.5 Control Panel Options

The chassis can support either of two control panels: a Standard Control Panel and an Intel® Local Control Panel with LCD support. The control panel assemblies are pre-assembled and modular in design. The entire module assembly slides into a predefined slot in the front of the chassis.

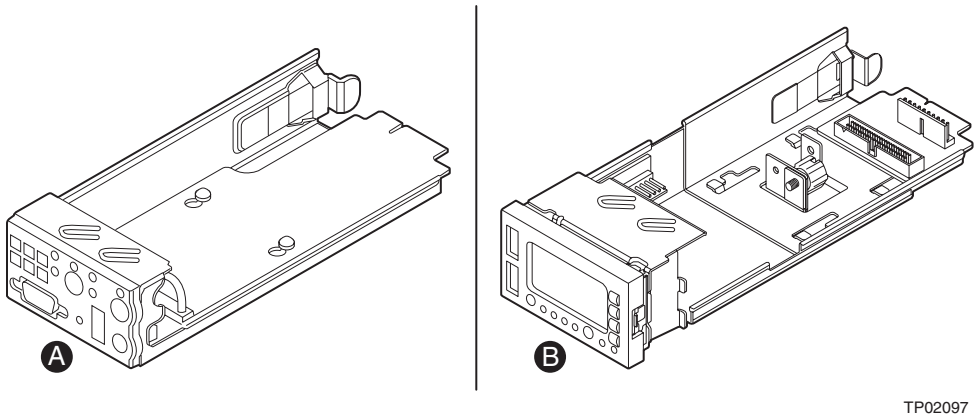


Figure 6. Control Panel Modules

The standard control panel supports several push buttons and status LEDs, along with USB and video ports to centralize system control, monitoring, and accessibility. The following diagram overviews the layout and functions of the control panel.

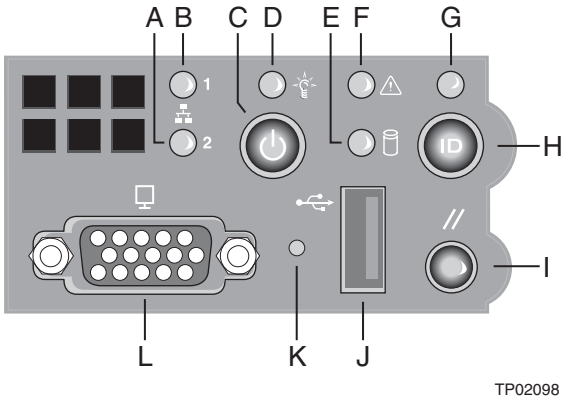


Figure 7. Standard Control Panel Overview

A. NIC #2 Activity LED
B. NIC #1 Activity LED
C. Power / Sleep Button
D. Power / Sleep LED
E. Hard Drive Activity LED
F. System Status LED
G. System Identification LED
H. System Identification Button
I. System Reset Button
J. USB 2.0 Connector
K. Recessed NMI Button (Tool Required)
L. Video Connector

The Intel® Local Control Panel utilizes a combination of control buttons, LEDs, and an LCD display to provide system accessibility, monitoring, and control functions. The following diagram provides an overview of this control panel.

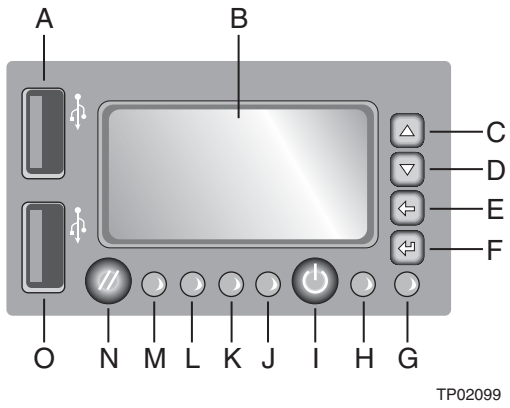


Figure 8. LCD Control Panel Overview

A	USB 2.0 Port	I	Power/Sleep Button
B	LCD Display	J	System Status LED
C	Menu Control Button, Scroll up	K	NIC 2 Activity LED
D	Menu Control Button, Scroll down	L	NIC 1 Activity LED
E	Menu Control Button, Scroll left	M	Hard Disk Drive Activity LED
F	Menu Control Button, Enter	N	Reset Button
G	System Identification LED	O	USB 2.0 Port
H	Power/Sleep LED		

1.6 Hard Drive and Peripheral Bays

The chassis is designed to support several different hard drive and peripheral configurations. The system includes a hot swap backplane capable of supporting either SAS or SATA drives. The sixth bay (see letter “B” in the figure below) can optionally be configured to support a sixth hard drive or 3.5” tape drive.

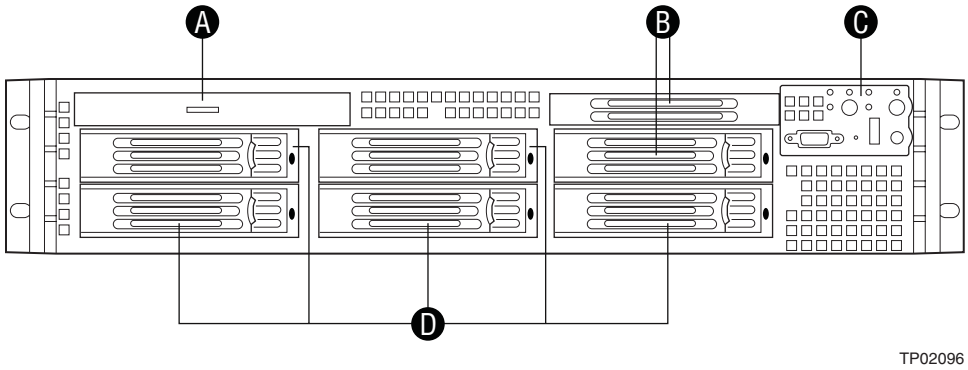


Figure 9. Front Panel Feature Overview

A. Slimline Optical Drive Bay
B. 6th HDD Drive or Tape Drive Bay (Optional)
C. System Control Panel
D. 3.5” Hard Drive Bays (5)

1.7 Power Sub-system

The power subsystem of the chassis consists of an integrated power distribution board and module enclosure which is capable of housing up to two 750 Watt power supply modules supporting 1+0 or redundant 1+1 power configurations. In a 1+1 redundant configuration, each power supply module is hot-swappable should one fail.

The power sub-system has several integrated management features including:

- Status LED on each power module
- Over-temperature protection circuitry
- Over-voltage protection circuitry

With the addition of server management software, the power subsystem is capable of supporting several system management features including:

- Remote Power On/Off
- Status Alerting
- FRU Information Reporting

Each power supply module operates within the following voltage ranges and ratings:

PARAMETER	MIN	RATED	MAX	Start-up Vac	Power Off Vac	Max Input AC Current	Max Rated Input AC Current
Line Voltage (110)	$90V_{rms}$	100-127 V_{rms}	$140V_{rms}$	85Vac ±4Vac	75Vac ±5Vac	12 A_{rms} [1,3]	11.0A_{rms} [4]
Line Voltage (220)	$180V_{rms}$	200-240 V_{rms}	$264V_{rms}$	-	-	6.0 A_{rms} [2,3]	5.5A_{rms} [4]
Frequency	47 Hz	50/60Hz	63 Hz				

1 Maximum input current at low input voltage range shall be measured at 90Vac, at max load.
2 Maximum input current at high input voltage range shall be measured at 180VAC, at max load.
3 This is not to be used for determining agency input current markings.
4 Maximum rated input current is measured at 100VAC and 200VAC.

1.8 System Cooling

The chassis is offered with two system cooling options. The first option is a three fan solution providing sufficient airflow to maintain internal system thermal requirements when the external ambient temperature remains within specified limits. The second option is a 5+1 fan configuration. Refer to section 3.2 for details. Should a single fan failure occur, this option provides support for hot-swap fans and fan redundancy.

In addition to the system fan options, each power supply module installed provides two additional non-redundant fans which pull air from inside the chassis out the back.

1.9 Chassis Security

The chassis provides support for a lockable front bezel which prevents unauthorized access to the system control buttons and hard drives. In addition, a chassis intrusion switch is provided allowing server management software to monitor removal of the top cover from the chassis.

1.10 Rack and Cabinet Mounting Options

The chassis was designed to support 19” wide by up to 30” deep server cabinets. The chassis supports three rack mount options:

- A fixed mount relay rack / cabinet mount kit (Product order code - AXXBRACKETS) which can be configured to mount the system into either a 2-post rack or 4-post cabinet

- A tool-less full extracting slide rail kit (Product order code – AXXHERAIL) designed to support an optional cable management arm (Product order code – AXXRACKCARM).

- A basic slide rail kit (Product order code – AXXBASICRAIL) designed to mount the chassis into a standard (19” by up to 30” deep) EIA-310D compatible server cabinet.

1.11 Front Bezel Features

The optional front bezel is made of molded plastic and uses a snap-on design. When installed, its design allows for maximum airflow to maintain system cooling requirements.

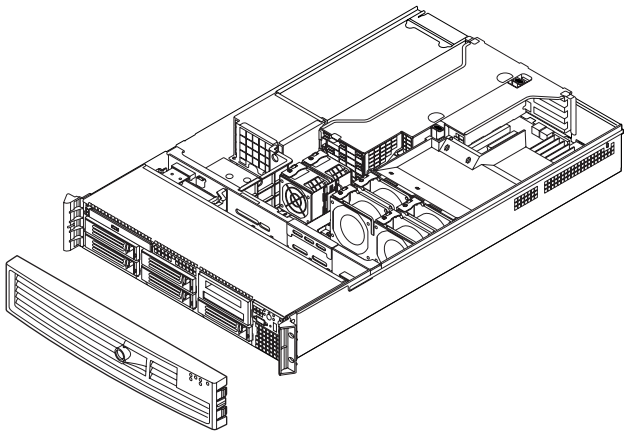


Figure 10. Optional Front Bezel

Separate front bezels are available to support systems that use either a standard control panel or the Intel® Local Control Panel with LCD support.

When the standard control panel is used, light pipes on the backside of the front bezel allow the system status LEDs to be monitored with the front bezel in the closed position. The front bezel lock is provided to prevent unauthorized access to hard drives, peripheral devices and the control panel.

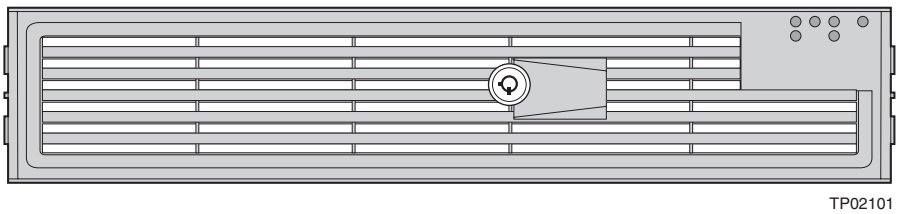


Figure 11. Front Bezel Supporting Standard Control Panel

When the local control panel is used, the control panel module can be adjusted to extend further out from the chassis face to allow the LCD panel to protrude from the front bezel.

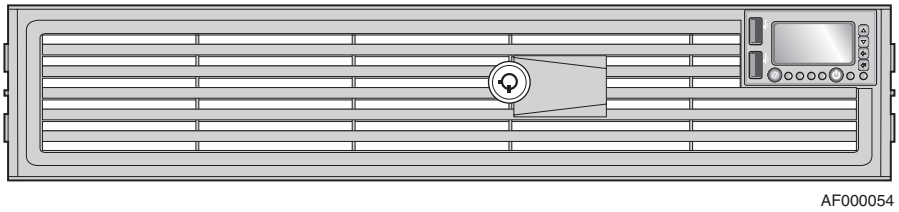


Figure 12. Front Bezel Supporting Intel® Local Control Panel

2. Power Sub-System

The power sub-system of the chassis consists of an integrated Power Distribution Module (PDM), a power module enclosure, and support for up to two 750 Watt power supply modules. The power sub-system can be configured to support a single module in a 1+0 non-redundant configuration, or dual modules in a 1+1 redundant power configuration. In a 1+1 configuration, a single failed power module can be hot-swapped with the system running. Either configuration will support up to a maximum of 750 Watts of power.

This chapter provides technical details to the operation of the power supply module and power sub-system. For additional information refer to the *Intel® Server Chassis SR2500 AC Power Supply Specification* and the *Intel® Server Chassis SR2500 Power Distribution Module Specification*.

2.1 Mechanical Overview

The drawing below displays the Power Distribution Module and the power supply module enclosure assembly.

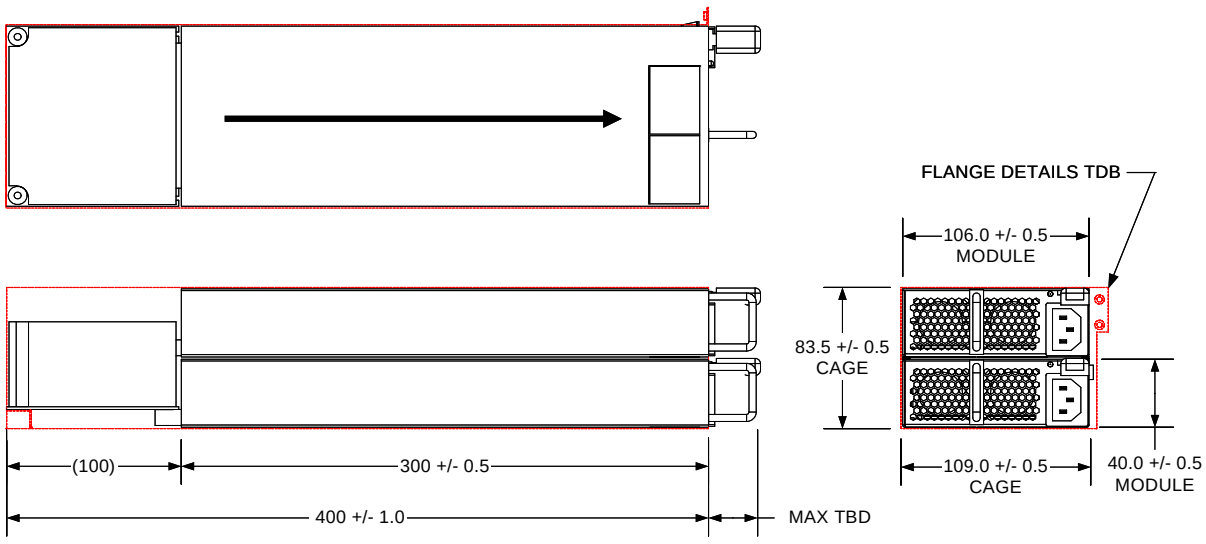


Figure 13. Mechanical Drawing for Dual (1+1 configuration) Power Supply Enclosure with PDM

2.2 Single Power Supply Module Population

In single power module configurations, server management firmware requires that the power supply module be populated in the bottom power module slot. The non-operating slot must have the power supply blank installed.

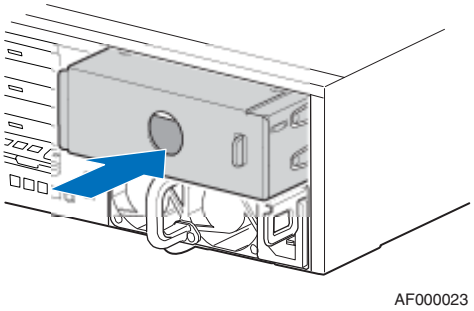


Figure 14. Power Supply Blank

Configuring a single power supply module in the top location will cause the server management firmware and BIOS to generate a system error during POST and the error will be reported to the System Event Log (SEL).

2.3 Handle and Retention Mechanism

Each power supply module includes a handle for module insertion to or removal from the module enclosure. Each module has a simple retention mechanism to hold the power module in place once it is inserted. This mechanism will withstand the specified platform mechanical shock and vibration requirements. The tab on the retention mechanism is colored **Green** to indicate it is a hot-swap touch point. The latch mechanism is designed to prevent insertion or removal of the module with the power cord plugged in. This will aid the hot-swapping procedure.

2.4 Hot-swap Support

Hot-swapping a power supply module is the process of extracting and re-inserting a power supply module from an operating power system. During this process the output voltages shall remain within specified limits. Up to two power supply modules may be on a single AC line. The power supply module can be hot-swapped by the method listed below.

Extraction: on removal, the power cord is unplugged first, and then the power module is removed. This can be done in standby mode or power-on mode.

Insertion: The module is inserted first, and then the power cord is plugged in. If powered off, the system and the power supply will power on into standby mode or power-on mode.

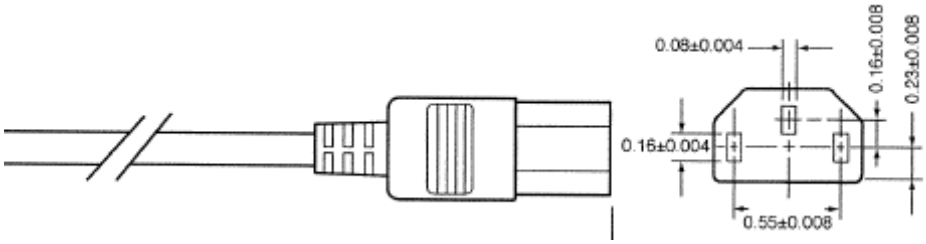
2.5 Airflow

Each power supply module incorporates two non-redundant 40mm fans for self cooling and partial system cooling. The fans will provide no less than **10 CFM** airflow through the power supply when installed in the system and operating at maximum fan speed. The cooling air will enter the power module from the PDB side (pre-heated air from the system).

2.6 AC Power Cord Specification Requirements

The AC power cord used must meet the following specification requirements:

Cable Type	SJT
Wire Size	16 AWG
Temperature Rating	105º C
Amperage Rating	13A
Voltage Rating	125V



2.7 Output Cable Harness

The power distribution board provides a cable harness providing connectors to the various system boards. The harness size, connectors, and pin outs are shown below. Listed or recognized component appliance wiring material (AVLV2), CN, rated 105°C min, 300Vdc min shall be used for all output wiring.

Table 2. Power Harness Cable Definitions

Length mm	To connector #	No of pins	Description
90, 90° angle	P1	2x12	Main Power Connector
115, 90° angle	P2	2x4	Processor Power Connector
100	P3	1x5	Server Board Signal Connector
150	P4	2x4	Backplane Power Connector
220	P5	2x5	Mid-plane Power Connector

2.7.1 P1 – Server Board Power Connector

Connector housing: 24- Pin Molex* Mini-Fit Jr. 39-01-2245 or equivalent

Contact: Molex Mini-Fit, HCS, Female, Crimp 44476 or equivalent

Table 3. P1 Main Power Connector

PIN	SIGNALS	18 AWG COLOR	PIN	SIGNAL	18 AWG COLORS
1	+3.3 VDC	Orange	13	+3.3 VDC	Orange
2	+3.3 VDC	Orange	14	-12 VDC	Blue
3	COM (GND)	Black	15	COM	Black
4	5 VDC	Red	16	PS_ON#	Green
	5V RS	Red (24 AWG)	17	COM	Black
5	COM	Black	18	COM	Black
6	+5 VDC	Red	19	COM	Black
7	COM	Black	20	*Reserved (-5V in ATX)*	*N.C.*
8	PWR OK	Gray	21	+5 VDC	Red
9	5Vsb	Purple	22	+5 VDC	Red
10	+12 V3	Yellow/Blue	23	+5 VDC	Red
11	+12 V3	Yellow/Blue	24	COM	Black
12	+3.3 VDC	Orange			

2.7.2 P2 – Processor Power Connector

Connector housing: 8- Pin Molex 39-01-2085 or equivalent

Contact: Molex 44476-1111 or equivalent

Table 4. P2 Processor Power Connector

PIN	SIGNAL	18 AWG COLORS	PIN	SIGNAL	18 AWG COLORS
1	COM	Black	5	+12 V1	Yellow
2	COM	Black	6	+12 V1	Yellow
3	COM	Black	7	+12 V2	Yellow/Black
4	COM	Black	8	+12 V2	Yellow/Black

2.7.3 P3 – Power Signal Connector

Connector housing: 5-pin Molex 50-57-9705 or equivalent

Contacts: Molex 16-02-0087 or equivalent

Table 5. P3 Power Signal Connector

PIN	SIGNAL	24 AWG COLORS
1	I2C Clock (SCL)	White/Green
2	I2C Data (SDL)	White/Yellow
3	SMBAlert#	White
4	ReturnS	Black
5	3.3RS	White/Brown

2.7.4 P4 – Backplane Power Connector

Connector housing: 8 Pin Molex Mini-Fit Jr. PN# 39-01-2245 or equivalent

Contact: Molex Mini-Fit, HCS, Female, Crimp 44476 or equivalent

Table 6. P4 Hot Swap Backplane Power Connector

PIN	SIGNAL	18 AWG COLORS	PIN	SIGNAL	18 AWG COLORS
1	COM	Black	5	+12 V4	Yellow/Green
2	COM	Black	6	+12 V4	Yellow/Green
3	+5V	Red	7	+5Vsb	Purple
4	+5V	Red	8	+3.3V	Orange

2.7.5 P5 Mid-plane Power Connector

Connector housing: 10 Pin Molex Mini-Fit Jr. 43025-1000 or equivalent

Contact: Molex Mini-Fit, HCS, Female, Crimp 43030-0007 or equivalent

Table 7. P5 Mid-plane Power Connector

PIN	SIGNAL	20 AWG Colors	PIN	SIGNAL	20 AWG Colors
1	COM	Black	6	+12 V4	Yellow/Green
2	COM	Black	7	+12 V4	Yellow/Green
3	+5V	Red	8	+12 V4	Yellow/Green
4	+3.3V	Orange	9	+12 V4	Yellow/Green
5	COM	Black	10	+5Vsb	Purple

2.8 AC Input Requirements

The power supply module incorporates universal power input with active power factor correction, which reduces line harmonics in accordance with the EN61000-3-2 and JEIDA MITI standards. P

2.8.1 Efficiency

The following table provides the required minimum efficiency level at various loading conditions. These are provided at three different load levels; 100%, 50% and 20%. Efficiency is tested over an AC input voltage range of 115VAC to 220VAC.

Table 8. Efficiency

Loading	100% of maximum	50% of maximum	20% of maximum
Recommended Efficiency	~80%	~83%	~78%

2.8.2 AC Input Voltage Specification

The power supply must operate within all specified limits over the input voltage range shown in the following table.

Table 9. AC Input Rating

PARAMETER	MIN	RATED	MAX	Start-up Vac	Power Off Vac	Max Input AC Current	Max Rated Input AC Current
Line Voltage (110)	$90V_{rms}$	100-127 V_{rms}	$140V_{rms}$	**85Vac ±4Vac**	**75Vac ±5Vac**	**12 A_{rms} [1,3]**	**11.0A_{rms} [4]**
Line Voltage (220)	$180V_{rms}$	200-240 V_{rms}	$264V_{rms}$	**-**	-	**6.0 A_{rms} [2,3]**	**5.5A_{rms} [4]**
Frequency	47 Hz	50/60Hz	63 Hz				

Notes:
1. Maximum input current at low input voltage range shall be measured at 90Vac, at max load.
2. Maximum input current at high input voltage range shall be measured at 180VAC, at max load.
3. This is not to be used for determining agency input current markings.
4. Maximum rated input current is measured at 100VAC and 200VAC.

Harmonic distortion of up to 10% of the rated AC input voltage must not cause the power supply to go out of specified limits. The power supply shall power off at or below 75Vac ±5Vac. The power supply shall start up at or above 85VAC ±4Vac. Application of an input voltage below 85VAC shall not cause damage to the power supply or blow a fuse.

2.8.3 AC Line Dropout / Holdup

An AC line **dropout** is defined to be when the AC input drops to 0VAC at any phase of the AC line for any length of time. During an AC dropout of one cycle or less the power supply must meet dynamic voltage regulation requirements over the rated load. If the AC dropout lasts longer than one cycle the power supply should recover and meet all turn-on requirements. The power supply must meet the AC dropout requirement over rated AC voltages, frequencies, and output loading conditions. Any dropout of the AC line shall not cause damage to the power supply.

20ms Min when tested under the following conditions: Max combined load = 525W,
12ms Min when tested under the following conditions: Max combined load = 750W

2.8.4 AC Line 5 VSB Holdup

The 5VSB output voltage should stay in regulation under its full load (static or dynamic) during an AC dropout of **70ms** min (=5VSB holdup time) whether the power supply is in ON or OFF state (PSON asserted or de-asserted).

2.8.5 AC Inrush

AC line inrush current shall not exceed **40A peak** for up to one-quarter of the AC cycle, after which, the input current should be no more than the specified maximum input current. The peak inrush current shall be less than the ratings of its critical components (including input fuse, bulk rectifiers, and surge limiting device).

The power supply must meet the inrush requirements for any rated AC voltage, during turn on at any phase of AC voltage, during a single cycle AC dropout condition as well as upon recovery after AC dropout of any duration, and over the specified temperature range (T_{op}). It is acceptable that AC line inrush current may reach up to **60A peak** for up to 1 msec.

2.9 Protection Circuits

Protection circuits inside the PDB and the power supply shall cause the power supply's main +12V output to shut down, or shall cause a shut down of any of the three outputs on the PDB. Either of these shutdowns will result in shutting down the entire power supply / PDB combination. If the power supply latches off due to a protection circuit tripping, an AC cycle OFF for 15 seconds shall be able to reset the power supply and the PDB.

2.9.1 Over-Current Protection (OCP)

Each DC/DC converter output on the PDB shall have individual OCP protection circuits. The power supply and power distribution board (PS and PDB) shall shutdown and latch off after an over-current condition occurs. This latch shall be cleared by an AC power interruption. The following table provides the over-current limits. The values are measured at the PDB harness connectors. The DC/DC converters shall not be damaged from repeated power cycling in this condition. The +12V output from the power supply is divided on the PDB into four channels and each is limited to 240VA of power. There shall be current sensors and limit circuits to shut down the entire PS and PDB if the limit is exceeded. The limits are listed below.

Table 10. Over-Current Protection Limits / 240VA Protection

Output Voltage	MIN OCP TRIP LIMITS	MAX OCP TRIP LIMITS
+3.3V	110% min (= 26.4A min)	150% max (= 36A max)
+5V	110% min (= 33A min)	150% max (= 45A max)
-12V	125% min (= 0.625A min)	400% max (= 2.0A max)
+12V1	112.5% min (= 18.0A min)	20A max
+12V2	112.5% min (= 18.0A min)	20A max
+12V3	112.5% min (= 18.0A min)	20A max
+12V4	112.5% min (= 18.0A min)	20A max

2.9.2 Over-Voltage Protection (OVP)

Each DC/DC converter output on the PDB shall have individual OVP circuits built in and they shall be locally sensed. The PS and PDB shall shutdown and latch off after an over-voltage condition occurs. This latch shall be cleared by an AC power interruption. The following table provides the over-voltage limits. The values are measured at the PDB harness connectors. The voltage shall never exceed the maximum levels when measured at the power pins of the output harness connector during any single point of fail. The voltage shall never trip any lower than the minimum levels when measured at the power pins of the PDB connector.

Table 11. Over-Voltage Protection (OVP) Limits

Output Voltage	OVP MIN (V)	OVP MAX (V)
+3.3V	3.9	4.5
+5V	5.7	6.5
+5VSB	5.7	6.5
-12V	-13.3	-14.5
+12V1/2/3/4	13.0	14.5

2.9.3 Over-Temperature Protection (OTP)

The power supply will be protected against over-temperature conditions caused by loss of fan cooling or excessive ambient temperature. In an OTP condition the power supply will shutdown. When the power supply temperature drops to within specified limits, the power supply shall restore power automatically, while the 5 Vsb remains constantly on. The OTP trip level shall have a minimum of 4°C of ambient temperature hysteresis, so that the power supply will not oscillate on and off due to a temperature recovery condition. The power supply shall alert the system of the OTP condition via the power supply FAIL signal and the PWR LED.

2.10 DC Output Specification

2.10.1 Output Power / Currents

The following table defines power and current ratings for this **750W** continuous (860W pk) power supply in 1+0 or 1+1 redundant configuration. The combined output power of both outputs shall not exceed the rated output power. The power supply must meet both static and dynamic voltage regulation requirements for the minimum loading conditions. Also, the power supply shall be able to supply the listed peak currents and power for a minimum of 10 seconds. Outputs are not required to be peak loaded simultaneously.

	+12V	+5Vsb
MAX Load	62.0A	3.0A
MIN DYNAMIC Load	3.0A	0.1A
MIN STATIC Load	0.0A	0.1A
PEAK Load	70.0A(12s min)	5.0A (0.5s min @ turn-on)
Max Output Power (continuous)	12V x 62A = 744W max	5V x 3A = 15W max
Peak Output Power	12V x 70A = 840W pk	5V x 5A = 25W pk

2.10.2 Standby Output / Standby Mode

The 5Vsb output shall be present when an AC input greater than the power supply turn-on AC voltage is applied. Applying an external 5.25V to 5Vsb shall not cause the power supply to shut down or exceed operating limits. When the external voltage is removed the voltage shall return to the power supplies operating voltage without exceeding the dynamic voltage limits.

2.11 Power Supply Status LED

Each power supply module will have a single bi-color LED to indicate power supply status. The LED operation is defined below.

Table 12. LED Indicators

Power Supply Condition	Bi-Color LED
No AC power to all power supplies	**OFF**
No AC power to this PSU only (for 1+1 configuration) or Power supply critical event causing a shutdown: failure, fuse blown (1+1 only), OCP, OVP, Fan Failed	**AMBER**
Power supply warning events where the power supply continues to operate: high temp, high power, high current, slow fan.	**1Hz Blink AMBER**
AC present / Only 5VSB on (PS Off)	**1Hz Blink GREEN**
Output ON and OK	**GREEN**

The LED is visible on the rear panel of each installed power supply module.

3. Cooling Subsystem

Several components and configuration requirements make up the cooling sub-system of the chassis. These include the system fan module, the power supply fans, air baffles, CPU air duct, and drive bay population. All are necessary to provide and regulate the air flow and air pressure needed to maintain the system's thermals when operating at or below maximum specified thermal limits. See Table 55. System Environmental Limits.

Two system fan assembly options are available for this chassis. The first option is a non-redundant three fan solution providing sufficient airflow to maintain internal system thermal requirements when the external ambient temperature remains within specified limits. The second option is a redundant fan solution. Three parallel sets of fans are arranged in series to provide redundant cooling in the event of a single fan failure. Each cooling option utilizes two fan types: a 60mm variable speed fan and an 80mm variable speed fan.

The chassis uses a variable fan speed control engine to provide adequate cooling for the system at various ambient temperature conditions, under various server workloads, and with the least amount of acoustic noise possible. The fans operate at the lowest speed for any given condition in order to minimize acoustics. The Baseboard Management Controller (BMC) integrated on the Intel® Server Board S5000PAL is used for the variable fan speed control function. The controller monitors selective component temperatures and the ambient temperature, as well as each fan's RPM to determine the necessary airflow. The BMC sets the fan speeds to the appropriate RPM in order to maintain proper cooling. The BMC controller will also log errors into the System Event Log (SEL) when temperature sensors exceed their safe operating ranges, or if any of the fans fail to operate at safe airflow speeds. In the event of a fan failure, the BMC will boost the remaining fans to compensate for the lost air flow. A chassis with redundant fans can continue to operate in this degraded condition while the non-redundant chassis may not. If the cooling is not sufficient under a failed fan condition, the system will eventually shutdown to protect itself from thermal damage.

3.1 Non-redundant Fan Module

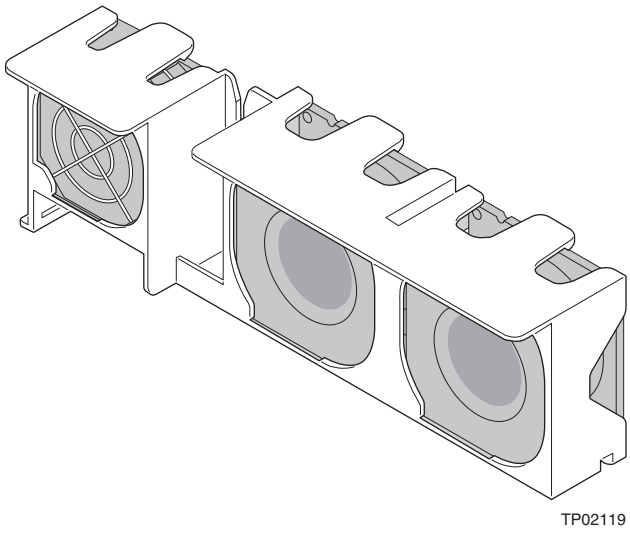


Figure 15. Non-Redundant Fan Module

This option provides the primary airflow for system configurations that do not require redundant cooling.

Table 13 Nonredundant Cooling Zones

Fan	Cooling Zone	Description of greatest cooling influence
System Fan #1	CPU1	Primary cooling for CPU1 and memory
System Fan #2	CPU2	Primary cooling for hard drives 4 and 5, CPU2, the MCH, and the low profile PCI cards
System Fan #3	PCI	Primary cooling for hard drives 2 and 3, Full Height PCI cards, PXH and IOP80333 chipset
Power Supply Fans 2 fans per module	Power Supply	Primary cooling for hard drives 0 and 1, and the power supply module(s)

The system fan module has been designed for ease of use and has support for several management features that can be utilized by the server board management system.

- The fan module houses two different fan sizes. System fans 1 and 2 use an 80mm fan, while system fan 3 uses a 60mm fan.
- Each fan is designed for tool-less insertion to or removal from the fan module housing. Note: The fans are NOT hot-swappable. The system must be turned off in order to replace a failed fan.
- Each fan within the module is capable of supporting multiple speeds. If the internal ambient temperature of the system exceeds the value programmed into the thermal sensor data record (SDR), the BMC firmware will increase the speed for all the fans within the fan module.
- Each fan connector within the module supplies a tachometer signal that allows the BMC to monitor the status of each fan. If one of the fans should fail, the remaining fans will increase their rotation and attempt to maintain the thermal requirements of the system.

- Each fan has an associated fault LED on the mid-plane located next to the fan header. In the event of a fan failure, the fault LED for the failing fan can be illuminated by system management.

Table 14. Non-redundant Fan Connector Pin Assingment

Pin	Signal Name	Description
1	Tachometer B	Reserved, unused by the non-redundant fan
2	PWM	Fan speed control signal
3	12V	Power for fan
4	12V	Power for fan
5	Tachometer A	Fan RPM sensor output Two pulse per revolution for the 80mm fan Four pulses per revolution for the 60mm fan
6	Return	Return path to ground
7	Return	Return path to ground
8	Fan Presence	Reserved, unused by the non-redundant fan
9	LED Cathode	Loopback signal to pin 10
10	LED Anode	Loopback signal to pin 9

The system fans plug into headers on the mid-plane board according to the following diagram.

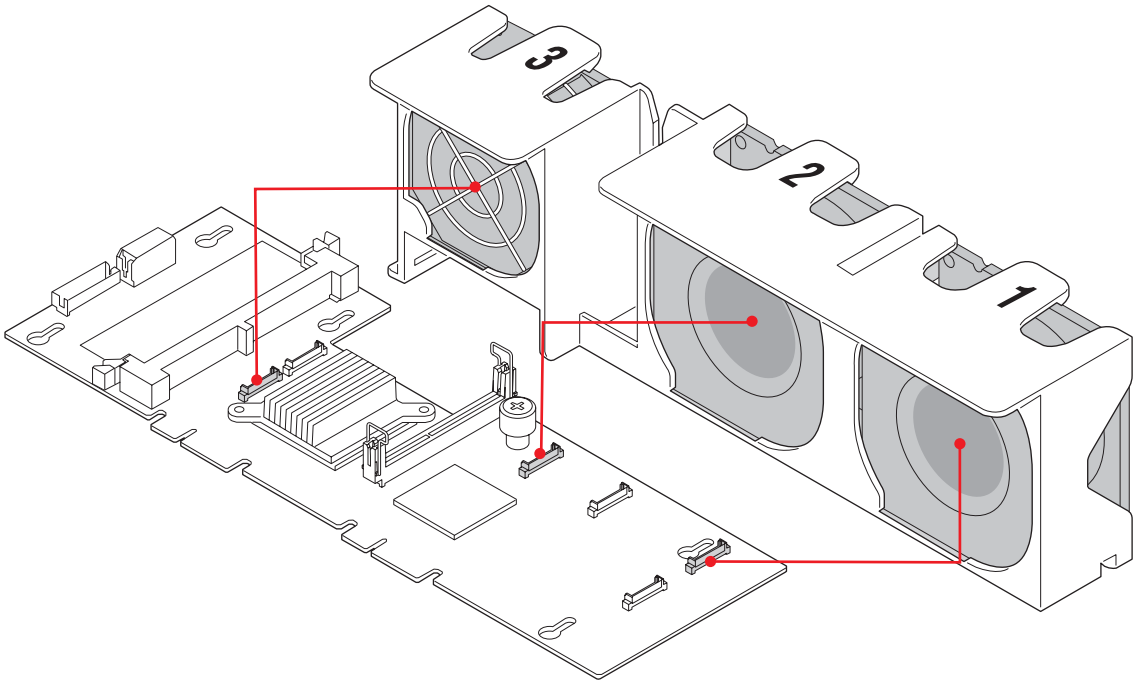


Figure 16. Non-Redundant Fan Header Assignments on Mid-plane

Table 15. Nonredundant Fan Header Assignment

Fan ID	Mid-plane Fan Header Name
Fan #1 - CPU1 cooling	FAN_2
Fan #2 - CPU2 cooling	FAN_4
Fan #3 - PCI Cooling	FAN_6

3.2 Redundant System Fan Module

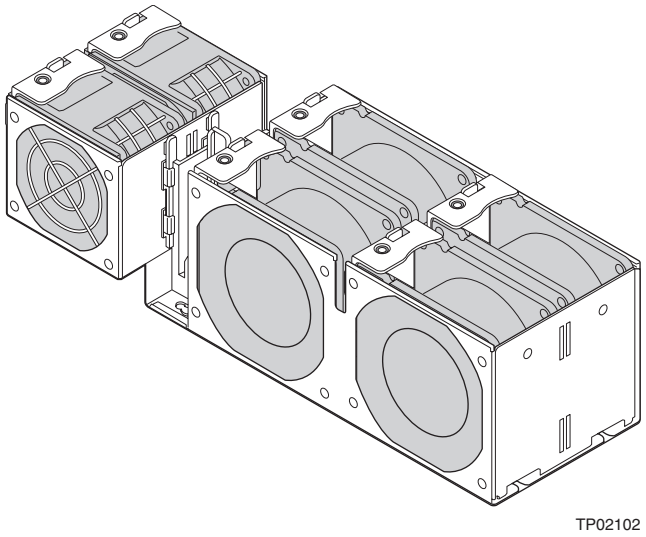


Figure 17. Fan Module Assembly

Table 16 Redundant Cooling Zones

Fan	Cooling Zone	Description of greatest cooling influence
System Fan #1 & #2	CPU1	Primary cooling for CPU1 and memory
System Fan #2 & #3	CPU2	Primary cooling for hard drives hard drives 4 and 5, CPU2, the BNB, and the low profile PCI cards
System Fan #5 & #6	PCI	Primary cooling for hard drives 2 and 3, Full Height PCI cards, PXH and IOP80333 chipset
Power Supply Fans 2 fans per module	Power Supply	Primary cooling for hard drives 0 and 1, and the power supply module(s)

Each 10-pin fan connector provides power and ground, PWM control, tachometer output, a fan present detection signal, and a fault LED signal allowing it to be monitored independently by server management software. The following table provides the pin-out and description for the connectors on each fan.

Table 17 Redundant Fan Connector Pin Assingment

Pin	Signal Name	Description
1	Tachometer B	Reserved, unused by redundant fan
2	PWM	Fan speed control signal
3	12V	Power for fan
4	12V	Power for fan
5	Tachometer A	Fan RPM sensor output Two pulses per revolution for the 80mm fan Four pulses per revolution for the 60mm fan
6	Return	Return path to ground
7	Return	Return path to ground
8	Fan Presence	Detection if fan is installed in system
9	LED Cathode	LED in fan
10	LED Anode	Reserved, unused by the redundant fan

The system fans are hot-pluggable and do not have any cable connections. They mate directly to the fan module. The system fan module plugs into headers on the mid-plane board according the following diagram.

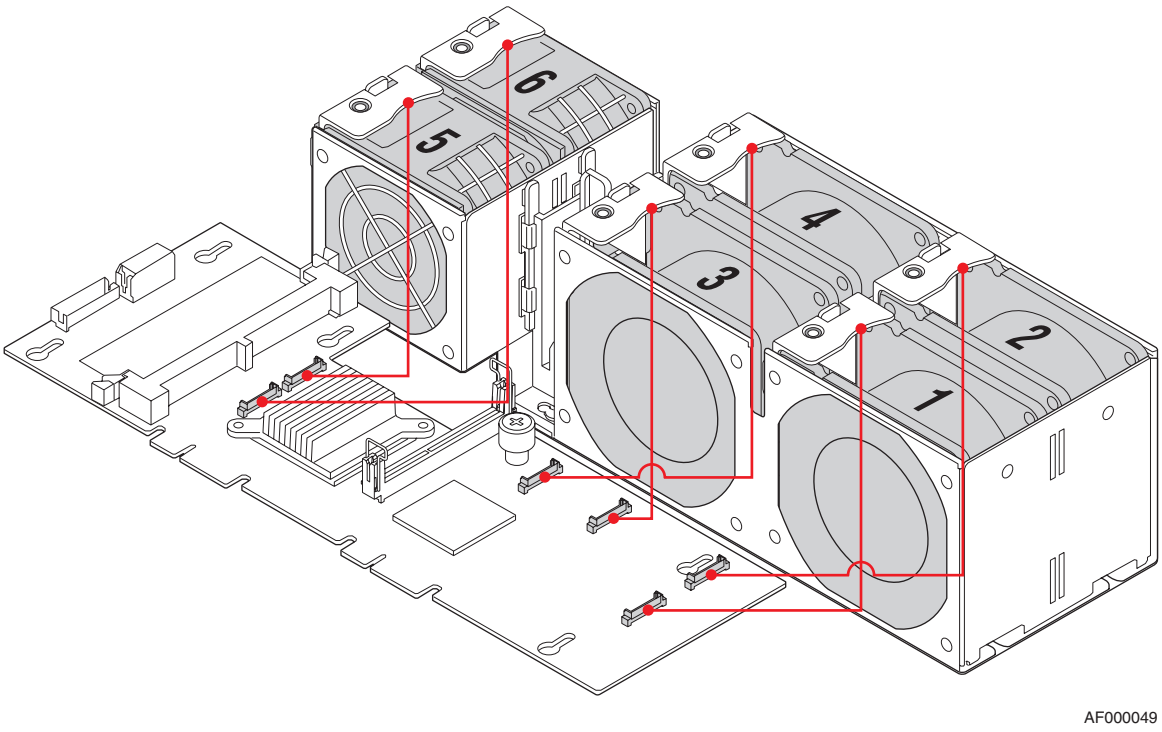


Figure 18. Redudant Fan Header Assignments on Mid-plane

Table 18 Redundant Fan Header Assignment

Fan ID	Mid-plane Fan Header Name
Fan #1 - CPU1 Cooling	FAN_1
Fan #2 - CPU1 Cooling	FAN_2
Fan #3 - CPU2 Cooling	FAN_3
Fan #4 - CPU2 Cooling	FAN_4
Fan #5 - PCI Cooling	FAN_5
Fan #6 - PCI Cooling	FAN_6

The system fan module has been designed for ease of use and has support for several management features that can be utilized by the server board management system.

- The fan module houses two different fan sizes. System fans 1, 2, 3 and 4 use an 80mm fan, while system fans 5 and 6 use a 60mm fan.
- Each fan is designed for tool-less insertion to or removal from the fan module and can be hot-swapped in the event of failure.
- Each fan within the module is equipped with a failure LED. In the event of a fan failure, the failure LED on the failing fan can be illuminated by server management.
- Each fan within the module is capable of supporting multiple speeds. If the internal ambient temperature of the system exceeds the value programmed into the thermal sensor data record (SDR), the BMC firmware will increase the speed for all the fans within fan module.
- Each fan connector within the module supplies a tachometer signal that allows the BMC to monitor the status of each fan. If one of the fans should fail, the remaining fans will increase their rotation and attempt to maintain the thermal requirements of the system.

3.3 Air Flow Support

To control airflow within the system, the chassis uses an air baffle and a CPU air duct to isolate and direct airflow to three critical zones: the power supply zone, the full height PCI riser zone, and the CPU/memory/low profile PCI riser zone.

3.3.1 Power Supply Zone

An air baffle is used to isolate the air flow of the main system board zones from the zone directly behind the power supply. As the power supply fans pull pre-heated air through the power supply from inside the chassis, the zone behind it must remain as cool as possible by drawing air from the leftmost drive bays only.

3.3.2 Full Height Riser Zone

The full height riser zone is the area between the power supply assembly and the full height riser card of the riser assembly. The air flow through this area is generated by system fan 3 of the fan module in a non-redundant fan configuration. In a redundant fan configuration, the air flow for this zone is provided by system fans 5 and 6. Air is drawn from the drive bay area through the fan and pushed out of the system through ventilation holes the back side of the chassis.

3.3.3 CPU / Memory / Low Profile PCI Zone

The CPU / memory / low profile PCI zone is the area between the low profile riser card of the riser assembly and the right chassis wall. In a non-redundant fan configuration, the air flow for this zone is generated by system fans 1 and 2 of the fan module. In a redundant fan configuration, the air flow for this zone is provided by system fans 1, 2, 3 and 4. Air is drawn from the drive bay area, through the fans, directed through the CPU air duct, and out through ventilation holes on both the back wall and rear side wall of the chassis.

The CPU air duct is used to direct air flow through the processor heat sinks for both single and dual processor configurations. For single processor configurations, a flexible air baffle is attached to the air duct as shown in the following diagram.

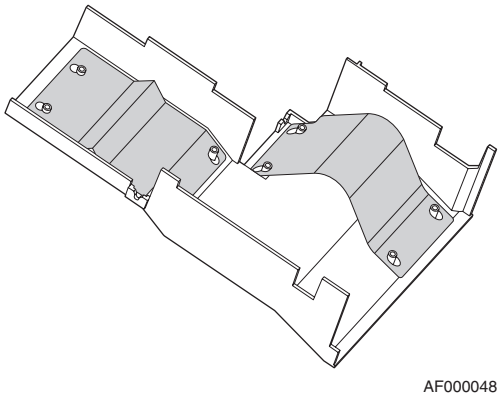


Figure 19. CPU Air Duct with Air Baffle

Operating a single processor configuration without the air baffle installed will result in the processor over heating and may cause the system to shutdown.

3.4 Drive Bay Population

To maintain the proper air pressure within the system, all hard drive bays must be populated with either a hard drive, or drive blank.

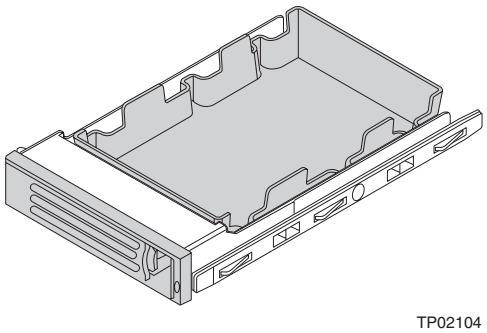


Figure 20. Drive Blank

4. System Board Interconnects

The chassis incorporates several design changes from the previous generation Intel 2U server chassis, resulting in improved cable routing. System boards within the chassis include the mid-plane, bridge board, hot-swap backplane, and control panel. This chapter describes the interconnect features of each, and defines the pin-outs for each of their connectors. Functional details of each system board are described in later chapters.

4.1 Mid-plane

The mid-plane is new to this generation of Intel high density server platforms. Its design and use, along with that of the bridgeboard and hot-swap backplane, improve cable routing within the system. The mid-plane is the key system board of the chassis. It serves as the primary interface between the server board, hot-swap backplane, and control panel. Two mid-planes are offered for this chassis: a passive SATA/SAS, and an active SAS/SAS RAID.

The passive midplane is a simple pass through from the backplane to the SATA connectors on the baseboard or SAS/SATA connectors on an add-in card.

The following diagram shows the location for each connector found on the passive mid-plane board.

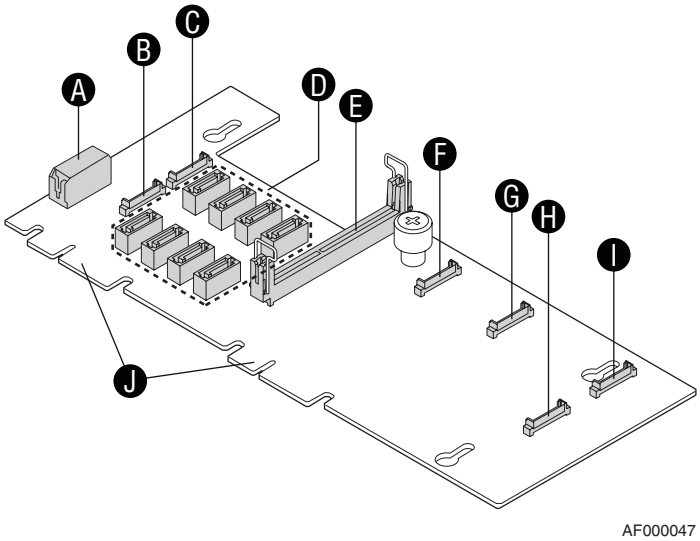


Figure 21. Passive Mid-plane Board

A	Power Connector	F	Fan 4 Connector
B	Fan 6 Connector	G	Fan 3 Connector
C	Fan 5 Connector	H	Fan 1 Connector
D	SAS/SATA Connectors	I	Fan 2 Connector
E	Bridge Board Connector	J	Backplane Connector

The chassis also supports an active SAS / SAS RAID mid-plane. This system board incorporates an LSI* LSISAS1068 SAS controller onto the board. See Chapter 5 for details describing SAS / SAS RAID support. The following diagram shows the location for each connector found on this board.

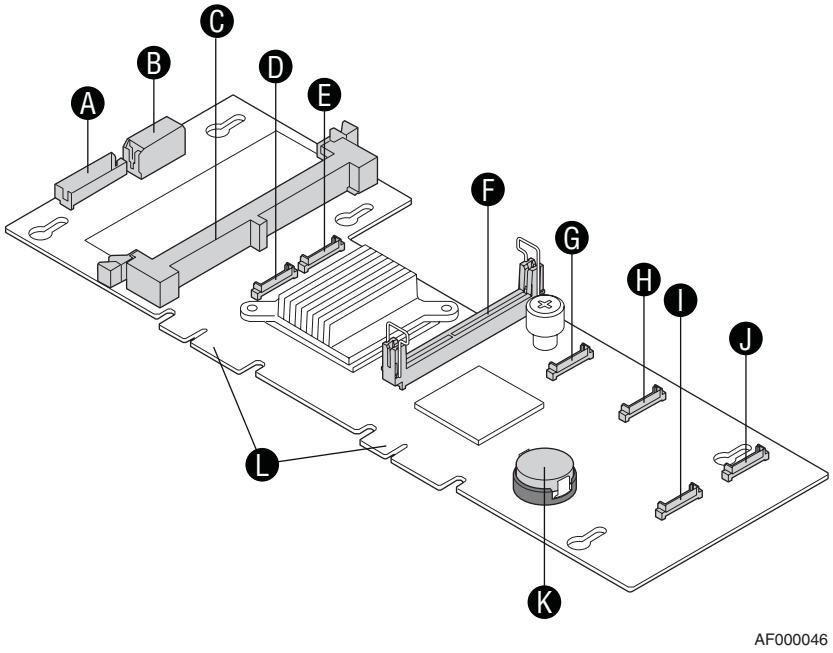


Figure 22. SAS/SAS RAID Mid-plane Board

A	RAID Activation Key Connector	G	Fan 4 Connector
B	Power Connector	H	Fan 3 Connector
C	Mini-DIMM Connector	I	Fan 1 Connector
D	Fan 6 Connector	J	Fan 2 Connector
E	Fan 5 Connector	K	Battery
F	Bridge Board Connector	L	Backplane Connector

The following tables define the connector pin-outs for both mid-plane boards.

Table 19. 120-pin Server Board-to-Mid-plane Bridge Board Connector Pin-out

PIN	SIGNAL NAME	PIN	SIGNAL NAME
1	GND	61	SMB_SENSOR_3V3SB_CLK_BUF
2	PE1_ESB_TX_DN3	62	SMB_SENSOR_3V3SB_DAT_BUF
3	PE1_ESB_TX_DP3	63	FM_BRIDGE_PRSNT_N
4	GND	64	GND
5	PE_WAKE_N	65	PE1_ESB_RX_DN_C3
6	GND	66	PE1_ESB_RX_DP_C3
7	PE1_ESB_TX_DN2	67	GND
8	PE1_ESB_TX_DP2	68	FAN_PRSNT6_N
9	GND	69	GND
10	FAN_PRSNT5_N	70	PE1_ESB_RX_DN_C2
11	GND	71	PE1_ESB_RX_DP_C2
12	PE1_ESB_TX_DN1	72	GND

PIN	SIGNAL NAME	PIN	SIGNAL NAME
13	PE1_ESB_TX_DP1	73	FAN_PRSNT4_N
14	GND	74	GND
15	RST_PS_PWRGD	75	PE1_ESB_RX_DN_C1
16	GND	76	PE1_ESB_RX_DP_C1
17	PE1_ESB_TX_DN0	77	GND
18	PE1_ESB_TX_DP0	78	RAID_KEY_PRES
19	GND	79	GND
20	FM_RAID_MODE	80	PE1_ESB_RX_DN_C0
21	GND	81	PE1_ESB_RX_DP_C0
22	CLK_IOP_DN	82	GND
23	CLK_IOP_DP	83	FAN_PRSNT1_N
24	GND	84	FAN_PRSNT3_N
25	SGPIO_DATAOUT1	85	FAN_PRSNT2_N
26	SGPIO_DATAOUT0	86	GND
27	SGPIO_LOAD	87	USB1_ESB_DP
28	SGPIO_CLOCK	88	USB1_ESB_DN
29	GND	89	GND
30	USB2_ESB_DP	90	USB1_ESB_OC_N
31	USB2_ESB_DN	91	USB0_ESB_OC_N
32	GND	92	GND
33	USB2_ESB_OC_N	93	USB0_ESB_DP
34	NIC1_LINK_LED_N	94	USB0_ESB_DN
35	NIC1_ACT_LED_N	95	GND
36	LED_STATUS_AMBER_R1	96	FP_NMI_BTN_N
37	NIC2_LINK_LED_N	97	BMC_RST_BTN_N
38	NIC2_ACT_LED_N	98	FP_PWR_BTN_N
39	LED_STATUS_GREEN_BUF_R1	99	FP_ID_SW_L
40	GND	100	GND
41	SMB_PBI_5VSB_DAT	101	SMB_IPMB_5VSB_DAT
42	SMB_PBI_5VSB_CLK	102	SMB_IPMB_5VSB_CLK
43	GND	103	GND
44	V_IO_HSYNC2_BUF_FP	104	LED_HDD_ACTIVITY_N
45	V_IO_VSYNC2_BUF_FP	105	LED_HDD_5V_A
46	GND	106	FP_PWR_LED_R_N
47	V_IO_BLUE_CONN_FP	107	FP_PWR_LED_3VSB
48	V_IO_GREEN_CONN_FP	108	FP_ID_LED_R1_N
49	V_IO_RED_CONN_FP	109	FM_SIO_TEMP_SENSOR
50	GND	110	LED_FAN3_FAULT
51	LED_FAN6_FAULT	111	LED_FAN2_FAULT
52	LED_FAN5_FAULT	112	LED_FAN1_FAULT
53	LED_FAN4_FAULT	113	FAN_PWM_CPU1
54	FAN_PWM3	114	GND
55	GND	115	FAN_PWM_CPU2
56	PCI_FAN_TACH10	116	PCI_FAN_TACH9
57	FAN_TACH8	117	FAN_TACH7
58	FAN_TACH6	118	FAN_TACH5
59	FAN_TACH4_H7	119	FAN_TACH3_H7
60	FAN_TACH2_H7	120	FAN_TACH1_H7

Table 20. Mid-plane Fan Header Pin-outs

J2B1 - FAN_1		J2B3 - FAN_3		J7B1 - FAN_5	
PIN	**SIGNAL NAME**	**PIN**	**SIGNAL NAME**	**PIN**	**SIGNAL NAME**
1	FAN_TACH5	1	FAN_TACH7	1	FAN_TACH10
2	FAN_PWM_CPU1	2	FAN_PWM_CPU2	2	FAN_PWM3
3	P12V	3	P12V	3	P12V
4	P12V	4	P12V	4	P12V
5	FAN_TACH1_H7	5	FAN_TACH3_H7	5	FAN_TACH9
6	GND	6	GND	6	GND
7	GND	7	GND	7	GND
8	FAN_PRSNT1_N	8	FAN_PRSNT3_N	8	FAN_PRSNT5_N
9	LED_FAN1_FAULT	9	LED_FAN3_FAULT	9	LED_FAN5_FAULT
10	LED_FAN1	10	LED_FAN3	10	LED_FAN5

J2B2 - FAN_2		J3B1 - FAN_4		J7B2 - FAN_6	
PIN	**SIGNAL NAME**	**PIN**	**SIGNAL NAME**	**PIN**	**SIGNAL NAME**
1	FAN_TACH6	1	FAN_TACH8	1	UNUSED
2	FAN_PWM_CPU1	2	FAN_PWM_CPU2	2	FAN_PWM3
3	P12V	3	P12V	3	P12V
4	P12V	4	P12V	4	P12V
5	FAN_TACH2_H7	5	FAN_TACH4_H7	5	FAN_TACH10
6	GND	6	GND	6	GND
7	GND	7	GND	7	GND
8	FAN_PRSNT2_N	8	FAN_PRSNT4_N	8	FAN_PRSNT6_N
9	LED_FAN2_FAULT	9	LED_FAN4_FAULT	9	LED_FAN6_FAULT
10	LED_FAN2	10	LED_FAN4	10	LED_FAN6

Table 21. Mid-plane Power Connector Pin-out

PIN	Signal Description
1	GND
2	GND
3	P5V
4	P3V3
5	GND
6	P12V
7	P12V
8	P12V
9	P12V
10	P5V_STBY

Table 22. Mid-plane-to-Backplane Card Edge Connector #1 Pin-out

J7A1 - HSBP#1 I/F			
PIN	**SIGNAL NAME**	**PIN**	**SIGNAL NAME**
A1	RST_PS_PWRGD	B1	GND
A2	GND	B2	SATA0_RX_N
A3	GND	B3	SATA0_RX_P
A4	SATA1_RX_N	B4	GND
A5	SATA1_RX_P	B5	GND
A6	GND	B6	SATA0_TX_N
A7	GND	B7	SATA0_TX_P
A8	SATA1_TX_P	B8	GND
A9	SATA1_TX_N	B9	GND
A10	GND	B10	USB2_ESB_DN
A11	GND	B11	USB2_ESB_DP
A12	USB2_ESB_OC_N	B12	GND
A13	GND	B13	SATA2_RX_N
A14	GND	B14	SATA2_RX_P
A15	SATA3_RX_N	B15	GND
A16	SATA3_RX_P	B16	NC_RESERVEDB16
A17	GND	B17	SMB_SAS_EDGE_DAT
A18	GND	B18	NC_RESERVEDB18
A19	GND	B19	SMB_SAS_EDGE_CLK
A20	SATA3_TX_P	B20	NC_RESERVEDB20
A21	SATA3_TX_N	B21	GND
A22	GND	B22	SATA2_TX_P
A23	GND	B23	SATA2_TX_N
A24	SATA5_RX_N	B24	GND
A25	SATA5_RX_P	B25	GND
A26	GND	B26	SATA4_RX_N
A27	GND	B27	SATA4_RX_P
A28	SATA5_TX_P	B28	GND
A29	SATA5_TX_N	B29	GND
A30	GND	B30	SATA4_TX_P
A31	GND	B31	SATA4_TX_N
A32	P5V_STBY	B32	GND

Table 23. Mid-plane-to-Backplane Card Edge Connector #2 Pin-out

J4A1 - HSBP#2 I/F			
PIN	**SIGNAL NAME**	**PIN**	**SIGNAL NAME**
A1	SGPIO_DATAOUT0	B1	SGPIO_CLOCK
A2	SGPIO_DATAOUT1	B2	GND
A3	GND	B3	SATA_ADDIN1_RX_N
A4	GND	B4	SATA_ADDIN1_RX_P
A5	SATA_ADDIN2_RX_N	B5	GND
A6	SATA_ADDIN2_RX_P	B6	GND
A7	GND	B7	SATA_ADDIN1_TX_N
A8	GND	B8	SATA_ADDIN1_TX_P
A9	SATA_ADDIN2_TX_P	B9	GND
A10	SATA_ADDIN2_TX_N	B10	GND
A11	GND	B11	SGPIO_LOAD
A12	SMB_PBI_3VSB_DAT	B12	SMB_IPMB_5VSB_DAT
A13	SMB_PBI_3VSB_CLK	B13	SMB_IPMB_5VSB_CLK
A14	USB0_ESB_OC_N	B14	GND
A15	GND	B15	USB1_ESB_DP
A16	GND	B16	USB1_ESB_DN
A17	USB0_ESB_DP	B17	GND
A18	USB0_ESB_DN	B18	GND
A19	GND	B19	USB1_ESB_OC_N
A20	LED_NIC1_ACT_N	B20	LED_HDD_ACTIVITY_N
A21	LED_NIC1_LINK_N	B21	LED_HDD_5V_A
A22	FM_SIO_TEMP_SENSOR	B22	FP_ID_SW_L
A23	LED_NIC2_LINK_N	B23	BMC_RST_BTN_N
A24	LED_NIC2_ACT_N	B24	FP_PWR_BTN_N
A25	GND	B25	FP_NMI_BTN_N
A26	V_BLUE_CONN_FP	B26	FP_PWR_LED_3VSB
A27	V_GREEN_CONN_FP	B27	FP_PWR_LED_R_N
A28	V_RED_CONN_FP	B28	FP_ID_LED_R1_N
A29	GND	B29	GND
A30	V_HSYNC2_BUF_FP	B30	LED_STATUS_AMBER_R1
A31	V_VSYNC2_BUF_FP	B31	LED_STATUS_GREEN_BUF_R1
A32	GND	B32	FP_LED

Table 24. Active Mid-plane SAS RAID Battery Backup Connector Pin-out

PIN	Signal Description
1	P12V
2	GND
3	NC_P5V_MONITOR
4	GND
5	P1V8_VBAT_RAID
6	GND
7	PWRGD_P3V3_STBY
8	GND
9	P1V8_VBAT_RAID
10	GND
11	PX_RESET_N
12	GND
13	SMB_CLK_P3V3
14	GND
15	SMB_DAT_P3V3
16	BBU_PFAIL_N
17	BBU_DDR_SEL
18	BBU_BBE
19	BBU_BBSTROBE
20	BBU_BBSTATUS

Table 25. Passive Mid-plane SATA/SAS Connector Pin-outs

J5A2 - SAS_7		J6A1 - SAS_6		J5B1 - SAS_4		J6B1 - SAS_2	
PIN	SIGNAL NAME	PIN	SIGNAL NAME	PIN	SIGNAL NAME	PIN	SIGNAL NAME
1	GND	1	GND	1	GND	1	GND
2	SATA_ADDIN1_TX_P	2	SATA5_TX_P	2	SATA3_TX_P	2	SATA1_TX_P
3	SATA_ADDIN1_TX_N	3	SATA5_TX_N	3	SATA3_TX_N	3	SATA1_TX_N
4	GND	4	GND	4	GND	4	GND
5	SATA_ADDIN1_RX_N	5	SATA5_RX_N	5	SATA3_RX_N	5	SATA1_RX_N
6	SATA_ADDIN1_RX_P	6	SATA5_RX_P	6	SATA3_RX_P	6	SATA1_RX_P
7	GND	7	GND	7	GND	7	GND

J5A1- SAS_8		J6A2 - SAS_5		J5B2 - SAS_3		J6B2 - SAS_1	
PIN	SIGNAL NAME	PIN	SIGNAL NAME	PIN	SIGNAL NAME	PIN	SIGNAL NAME
1	GND	1	GND	1	GND	1	GND
2	SATA_ADDIN2_TX_P	2	SATA4_TX_P	2	SATA2_TX_P	2	SATA0_TX_P
3	SATA_ADDIN2_TX_N	3	SATA4_TX_N	3	SATA2_TX_N	3	SATA0_TX_N
4	GND	4	GND	4	GND	4	GND
5	SATA_ADDIN2_RX_N	5	SATA4_RX_N	5	SATA2_RX_N	5	SATA0_RX_N
6	SATA_ADDIN2_RX_P	6	SATA4_RX_P	6	SATA2_RX_P	6	SATA0_RX_P
7	GND	7	GND	7	GND	7	GND

4.2 Bridge Board

The chassis utilizes a bridge board to route signals from the server board to the mid-plane board. The bridge board carries signals for three USB ports, SSI front panel control signals, video, various I2C buses, fan control signals, and a PCIe* x4 bus for SAS controller function. See Table 19. 120-pin Server Board-to-Mid-plane Bridge Board Connector Pin-out.

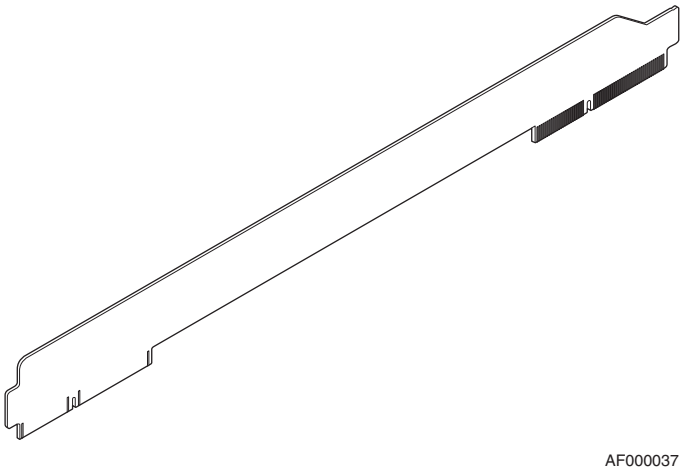


Figure 23. Bridge Board

4.3 Hot-Swap SATA/SAS Backplane

The hot swap backplane provides support for both SAS and SATA hard drives. There are no hard drive cables that connect to the backplane. All hard drive control signals are routed from the mid-plane board which plugs directly into the backplane.

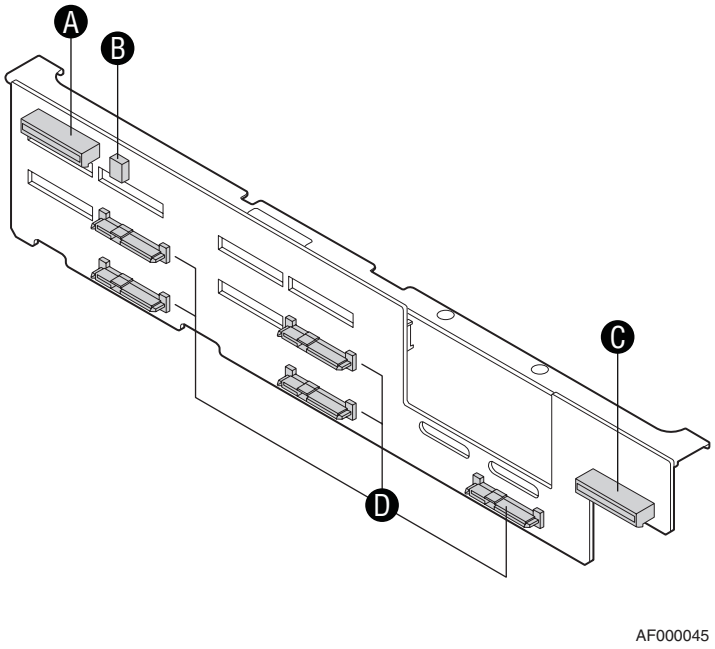


Figure 24. Hot-Swap SAS/SATA Backplane (Front Side View)

A	Slimline Optical Drive Connector	C	Control Panel Connector
B	USB Floppy Connector	D	SAS/SATA Hot Swap Connectors

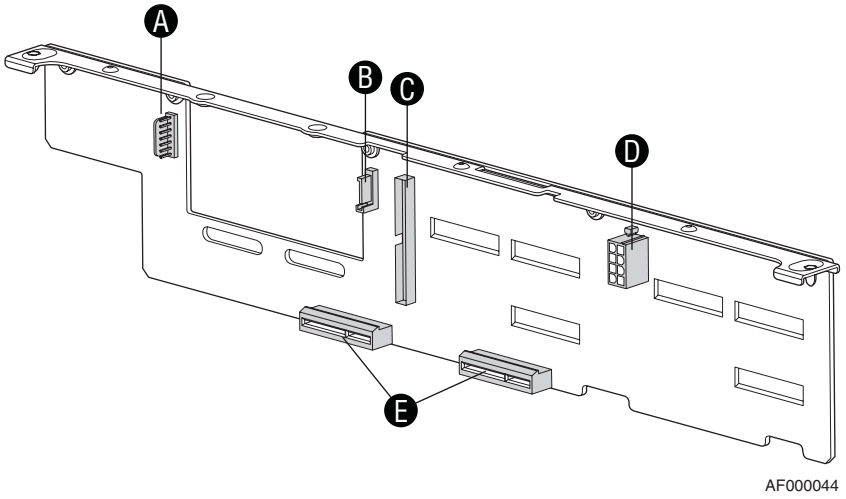


Figure 25. Hot-Swap SAS/SATA Backplane (Back Side View)

A	Power Connector (for 6th Hard Drive or SATA Tape Drive)	D	Power Connector
B	SAS/SATA Connector (for 6th Hard Drive or SATA Tape Drive)	E	Midplane Connector
C	IDE Connector		

Table 26. 2x4 SAS/SATA Backplane Power Connector Pin-out (J7L2)

Pin #	Signal Name
1	Ground
2	Ground
3	P5V
4	P5V
5	P12V
6	P12V
7	P5V_STBY
8	P3V3

Table 27. 1x7 6th HDD / Tape Drive Option Power Connector Pin-out (J2M1)

Pin #	Signal Name
1	P12V
2	Ground
3	Ground
4	P5V
5	SASS_PRSTNT_L
6	LED_SASS_ACT_L
7	P3V3

Table 28. 6th HDD Option SATA/SAS I/O Connector Pin-out (J4L1)

Pin #	Signal Name
1	Ground
2	SASS_TX_DP
3	SASS_TX_DN
4	Ground
5	SASS_RX_DN
6	SASS_RX_DP
7	Ground

Table 29. 2x22 Slim-Line IDE Optical Drive Connector Pin-out (J5N1)

Pin #	Signal Name	Pin #	Signal Name
1	RST_IDE_L	23	RIDE_DIOW_N
2	Ground	24	Ground
3	RIDE_DD <15..0> 7	25	RIDE_DIOR_N
4	RIDE_DD <15..0> 8	26	Ground
5	RIDE_DD <15..0> 6	27	RIDE_DIORDY
6	RIDE_DD <15..0> 9	28	IDE_ALE_H
7	RIDE_DD <15..0> 5	29	RIDE_DDACK_N
8	RIDE_DD <15..0> 10	30	Ground
9	RIDE_DD <15..0> 4	31	IRQ_IDE
10	RIDE_DD <15..0> 11	32	TP_PIDE_32
11	RIDE_DD <15..0> 3	33	RIDE_DA1
12	RIDE_DD <15..0> 12	34	IDE_PRI_CBLSNS
13	RIDE_DD <15..0> 2	35	RIDE_DA0

Pin #	Signal Name	Pin #	Signal Name
14	RIDE_DD <15..0> 13	36	RIDE_DA2
15	RIDE_DD <15..0> 1	37	RIDE_DCS1_N
16	RIDE_DD <15..0> 14	38	RIDE_DCS3_N
17	RIDE_DD <15..0> 0	39	LED_IDE_L
18	RIDE_DD <15..0> 15	40	Ground
19	Ground	41	Not Used
20	Not Used	42	Not Used
21	RIDE_DDREQ	43	Not Used
22	Ground	44	Not Used

Table 30. Slim-Line Optical Drive Slot Connector (J1A1)

Pin #	Signal Name			Pin #	Signal Name
A1	RST_IDE_L	PRSNT1_N	12V	B1	RIDE_DD<15..0> 8
A2	Ground	12V	12V	B2	Ground
A3	RIDE_DD<15..0> 7	12V	RSVD	B3	RIDE_DD<15..0> 9
A4	Ground	GND	GND	B4	Ground
A5	RIDE_DD<15..0> 6	JTAG2	SMCLK	B5	RIDE_DD<15..0> 10
A6	Ground	JTAG3	SMDAT	B6	Ground
A7	RIDE_DD<15..0> 5	JTAG4	GND	B7	RIDE_DD<15..0> 11
A8	Ground	JTAG5	3_3V	B8	Ground
A9	RIDE_DD<15..0> 4	3_3V	JTAG1	B9	RIDE_DD<15..0> 12
A10	Ground	3_3V	3_3VAUX	B10	Ground
A11	RIDE_DD<15..0> 3	PERST_N	WAKE_N	B11	RIDE_DD<15..0> 13
A12	Ground	----------KEY ----------		B12	Ground
A13	RIDE_DD<15..0> 2	GND	RSVD	B13	RIDE_DD<15..0> 14
A14	Ground	REFCLK+	GND	B14	Ground
A15	RIDE_DD<15..0> 1	REFCLK –	PETP0	B15	RIDE_DD<15..0> 15
A16	Ground	GND	PETN0	B16	Ground
A17	RIDE_DD<15..0> 0	PERP0	GND	B17	RIDE_DDREQ
A18	Ground	PERN0	PRSNT2_N	B18	Ground
A19	RIDE_DIOW_N	GND	GND	B19	RIDE__DIOR_N
A20	Ground	RSVD	PETP1	B20	Ground
A21	RIDE_DIORDY	GND	PETN1	B21	RIDE_DDACK_N
A22	Ground	PERP1	GND	B22	TP_PIDE_32
A23	IRQ_IDE	PERN1	GND	B23	IDE_PRI_CBLSNS
A24	Ground	GND	PETP2	B24	Ground
A25	RIDE_DA1	GND	PETN2	B25	RIDE_DA2
A26	Ground	PERP2	GND	B26	Ground
A27	RIDE_DA0	PERN2	GND	B27	RIDE_DCS3_N
A28	Ground	GND	PETP3	B28	P5V
A29	RIDE_DCS1_N	GND	PETN3	B29	P5V
A30	P5V	PERP3	GND	B30	P5V
A31	P5V	PERN3	RSVD	B31	IDE_ALE_S_H
A32	LED_IDE_L	GND	PRSNT2_N	B32	Ground
		RSVD	GND		

Table 31. IDE Device Master/Slave Configuration Jumper (J6L1)

Jumper Setting	Configuration
1-2	IDE Master
2-3	IDE Slave

Table 32. I2C Connector (J6L3)

Pin #	Signal Description

1	SMB_VSC_12C_DAT0
2	GROUND
3	SMB_VSC_12C_CLK0
4	Not Used

Table 33. PCIe X4 Slot Connector from Mid-plane (J4N1)

Pin #	Signal Name	Pin #	Signal Name
A1	SGPIO_DATA0	B1	SGPIO_CLOCK
A2	SGPIO_DATA1	B2	Ground
A3	Ground	B3	SAS6_RX_DN
A4	Ground	B4	SAS6_RX_DP
A5	SAS7_RX_DN	B5	Ground
A6	SAS7_RX_DP	B6	Ground
A7	Ground	B7	SAS6_TX_DN
A8	Ground	B8	SAS6_TX_DP
A9	SAS7_TX_DP	B9	Ground
A10	SAS7_TX_DN	B10	Ground
A11	Ground	B11	SGPIO_LOAD
A12	SMB_PB1_5VSB_DAT	B12	SMB_IPMB_5VSB_DAT
A13	SMB_PB1_5VSB_CLK	B13	SMB_IPMB_5VSB_CLK
A14	USB_OC1_N	B14	Ground
A15	Ground	B15	USB_P2P
A16	Ground	B16	USB_P2N
A17	USB_P1P	B17	Ground
A18	USB_P1N	B18	Ground
A19	Ground	B19	USB_OC2_N
A20	LED_NIC1_ACT_L	B20	LED_HDD_ACT_R_L
A21	LED_NIC1_LINK_R_L	B21	PV_HDD_LED_3V_A
A22	FP_THERM_SENSOR	B22	FP_ID_SW_L
A23	LED_NIC2_LINK_R_L	B23	RST_FP_BTN_L
A24	LED_NIC2_ACT_L	B24	FP_PWR_BTN_L
A25	Ground	B25	FP_NMI_BTN_L
A26	V_IO_BLUE_CONN_FP	B26	FP_PWR_LED_5VSB
A27	V_IO_GREEN_CONN_FP	B27	LED_FP_PWR_R_L
A28	V_IO_RED_CONN_FP	B28	LED_FP_ID_R_L
A29	Ground	B29	Ground
A30	V_IO_HSYNC_BUFF_FP_L	B30	LED_FP_SYS_FLT1_R_L
A31	V_IO_VSYNC_BUFF_FP_L	B31	LED_FP_SYS_FLT2_R_L
A32	Ground	B32	FP_FLT_LED_5VSB

Table 34. PCIe X4 Slot Connector from Mid-plane (J6N1)

Pin #	Signal Name	Pin #	Signal Name
A1	RST_PWRGD_PS	B1	Ground
A2	Ground	B2	SAS0_RX_DN
A3	Ground	B3	SAS0_RX_DP
A4	SAS1_RX_DN	B4	Ground
A5	SAS1_RX_DP	B5	Ground
A6	Ground	B6	SAS0_TX_DN
A7	Ground	B7	SAS0_TX_DP
A8	SAS1_TX_DP	B8	Ground
A9	SAS1_TX_DN	B9	Ground
A10	Ground	B10	USB_P3N
A11	Ground	B11	USB_P3P
A12	USB_OC3_N	B12	Ground
A13	Ground	B13	SAS2_RX_DN
A14	Ground	B14	SAS2_RX_DP
A15	SAS3_RX_DN	B15	Ground
A16	SAS3_RX_DP	B16	Not Used
A17	Ground	B17	SMB_SAS_3V3_SDA
A18	Ground	B18	Not Used
A19	Ground	B19	SMB_SAS_3V3_SCL
A20	SAS3_TX_DP	B20	Not Used
A21	SAS3_RT_DN	B21	Ground
A22	Ground	B22	SAS2_TX_DP
A23	Ground	B23	SAS2_TX_DN
A24	SAS5_RX_DN	B24	Ground
A25	SAS5_RX_DP	B25	Ground
A26	Ground	B26	SAS4_RX_DN
A27	Ground	B27	SAS4_RX_DP
A28	SAS5_TX_DP	B28	Ground
A29	SAS5_TX_DN	B29	Ground
A30	Ground	B30	SAS4_TX_DP
A31	Ground	B31	SAS4_TX_DN
A32	P5V_STBY	B32	Ground

Table 35. USB Floppy Drive Connector (J2A1)

Pin #	Signal Description
1	P5V_USB_FP_P3
2	USB_P3N
3	USB_P3P
4	Ground

Table 36. Intel® Local Control Panel (LCP) Connector (J9A1)

Pin #	Signal Description
1	SMB_IPMB_5VSB_DAT
2	Ground
3	SMB_IPMB_5VSB_CLK
4	P5V_STBY_R

Table 37. Control Panel Slot Connector (J9B1)

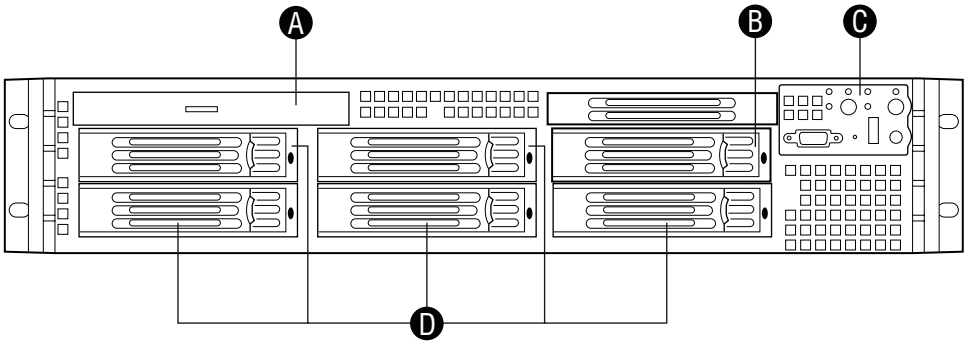
Pin #	Signal Name			Pin #	Signal Name
A1	Ground	PRSNT1_N	12V	B1	FP_THERM_SENSOR
A2	V_IO_VSYNC_BUFF_FP_L	12V	12V	B2	P5V
A3	Ground	12V	RSVD	B3	P5V
A4	V_IO_HSYNC_BUFF_FP_L	GND	GND	B4	P5V
A5	Ground	JTAG2	SMCLK	B5	V_VIDEO_IN_USE
A6	V_IO_BLUE_BUFF_FP_L	JTAG3	SMDAT	B6	Ground
A7	Ground	JTAG4	GND	B7	P5V_STBY
A8	V_IO_GREEN_BUFF_FP_L	JTAG5	3_3V	B8	Ground
A9	Ground	3_3V	JTAG1	B9	FP_FLT_LED_5VSB
A10	V_IO_RED_BUFF_FP_L	3_3V	3_3VAUX	B10	Ground
A11	Ground	PERST_N	WAKE_N	B11	LED_FP_SYS_FLT1_R_L
A12	Ground	---------- KEY ----------		B12	FP_ID_SW_L
A13	RST_FP_BTN_L	GND	RSVD	B13	LED_FP_ID_R_L
A14	Ground	REFCLK +	GND	B14	SMB_IPMB_5VSB_DAT
A15	FP_CHASSIS_INTRU	REFCLK –	PETP0	B15	SMB_IPMB_5VSB_CLK
A16	Ground	GND	PETN0	B16	Ground
A17	SMB_PB1_5VSB_DAT	PERP0	GND	B17	LED_NIC1_ACT_L
A18	SMB_PB1_5VSB_CLK	PERN0	PRSNT2_N	B18	LED_NIC1_LINK_R_L
A19	Ground	GND	GND	B19	FP_PWR_BTN_L
A20	FP_NMI_BTN_L	RSVD	PETP1	B20	FP_PWR_LED_5VSB
A21	Ground	GND	PETN1	B21	PV_HDD_LED_3V_A
A22	USB_P1P	PERP1	GND	B22	Ground
A23	USB_P1N	PERN1	GND	B23	Ground
A24	Ground	GND	PETP2	B24	LED_NIC2_ACT_L
A25	Ground	GND	PETN2	B25	LED_NIC2_LINK_R_L
A26	P5V_USB_P1	PERP2	GND	B26	LED_HDD_FLT_R_L
A27	P5V_USB_P2	PERN2	GND	B27	LED_HDD_ACT_RR_L
A28	Ground	GND	PETP3	B28	LED_FP_PWR_R_L
A29	Ground	GND	PETN3	B29	LED_FP_SYS_FLT2_R_L
A30	USB_P2P	PERP3	GND	B30	Ground
A31	USB_P2N	PERN3	RSVD	B31	Ground
A32	Ground	GND	PRSNT2_N	B32	RST_PWRGD_PS
		RSVD	GND		

Table 38. SAS/SATA Hard Drive Connector Pin-outs (J2C3, J2B1, J4C1, J4B1, J7C1)

Pin#	Signal Description
SI	Ground
S2	SAS#_TX_DP (# = 0…4)
S3	SAS#_TX_DN (# = 0…4)
S4	Ground
S5	SAS#_RX_DN (# = 0…4)
S6	SAS#_RX_DP (# = 0…4)
S7	Ground
S8	Not Used
S9	Not Used
S10	Not Used
S11	Not Used
S12	Not Used
S13	Not Used
S14	Not Used
P1	Not Used
P2	Not Used
P3	Not Used
P4	Ground
P5	Ground
P6	P3V3
P7	P5V
P8	P5V
P9	P5V
P10	Ground
P11	LED_SAS#_ACT_L (# = 0…4)
P12	Ground
P13	P12V
P14	P12V
P15	P12V
PTH0	Ground
PTY1	Ground

5. Peripheral and Hard Drive Sub-System

The chassis can be configured to support several different hard drive and peripheral configurations. The peripheral/hard drive sub-system consists of a drive bay, supporting a slimline optical drive, hard drives, and flex bay; a mid-plane; and hot-swap backplane. This chapter describes the details for each sub-system component.



A. Slimline IDE Optical Drive Bay
B. Optional 6th HDD Drive or Tape Drive Bay
C. System Control Panel
D. 3.5” Hard Drive Bays x5

Figure 26. Optional 6th Hard Drive (Front View)

5.1 Slimline Drive Bay

The chassis provides a slim-line drive bay that is designed to support a single slim-line IDE optical drive or USB Floppy Drive. A list of supported drives can be found in the Intel® Server Board S5000PAL/S5000XAL Tested Hardware and OS List. Either drive type is mounted to a tool-less tray which allows for easy installation into and removal from the chassis. Once inserted into the chassis, the assembly locks into place. It is not hot-swappable. For removal, the system must be powered down, the chassis top cover removed and the locking latch disengaged.

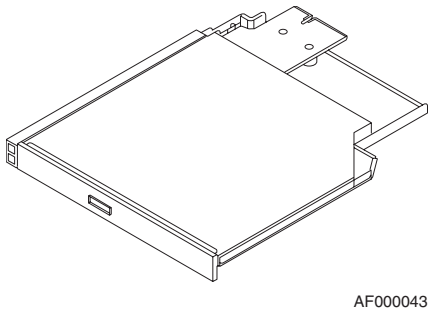


Figure 27. Slim-Line Optical Drive Assembly

The IDE Optical drive assembly includes an interposer board which plugs into the back of the optical drive. The interposer board is a card-edge type card that eliminates the need for cable connections. As the drive assembly is inserted into the drive bay, the edge connector is blind mated to a slot connector on the backplane.

The interposer board has two connectors. The first connector is the industry standard 50-pin IDE interface used by all slim-line optical devices. The second connector is the card edge used to connect directly to the hot-swap backplane board.

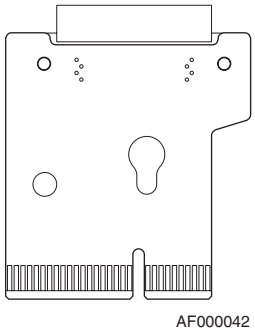


Figure 28. 50-pin Connector to Slimline Optical Device

Table 39. J1L1 50-pin Connector to Slimline Optical Device

PIN	SIGNAL NAME	PIN	SIGNAL NAME
1	TP_LCH	26	GND
2	TP_RCH	27	IDE_SIORDY
3	TP_GND	28	IDE_SDDACK_L
4	GND	29	IRQ_IDE_S
5	RST_IDE_S_L	30	IDEIO16_L
6	IDE_SDD8	31	IDE_SDA1
7	IDE_SDD7	32	IDE_CBL_DET_S
8	IDE_SDD9	33	IDE_SDA0
9	IDE_SDD6	34	IDE_SDA2
10	IDE_SDD10	35	IDE_SDCS0_L
11	IDE_SDD5	36	IDE_SDCS1_L
12	IDE_SDD11	37	IDE_SEC_HD_ACT_L
13	IDE_SDD4	38	P5V
14	IDE_SDD12	39	P5V
15	IDE_SDD3	40	P5V
16	IDE_SDD13	41	P5V
17	IDE_SDD2	42	P5V
18	IDE_SDD14	43	GND
19	IDE_SDD1	44	GND
20	IDE_SDD15	45	GND
21	IDE_SDD0	46	GND
22	IDE_SDDREQ	47	IDEP_ALE_H
23	GND	48	GND
24	IDE_SDIOR_L	49	UNUSED
25	IDE_SDIOW_L	50	UNUSED

The USB floppy drive assembly includes a USB cable which plugs into the back of the USB floppy drive and is then routed to the backplane's 4-pin USB connector J2A1 (See Table 35. USB Floppy Drive Connector (J2A1).

Note: The optional internal USB floppy drive accessory kit (product order code – AXXUSBFLOPPY) includes a slim-line USB floppy drive, a USB cable, and mounting hardware to install the drive into either the slim-line drive bay or one of the hard drive bays.

5.2 Hard Drive Bays

The chassis can be configured to support up to 6[1] hot-swap 3.5" x1" SAS or SATA hard disk drives. Hard drives are mounted to hot-swap drive trays for easy insertion to or extraction from the drive bay.

5.2.1 Hot-swap Drive Trays

Each hard drive must be mounted to a hot-swap drive tray, making insertion and extraction of the drive from the chassis very simple. Each drive tray has its own dual purpose latching mechanism which is used to both insert/extract drives from the chassis and lock the tray in place. Each drive tray supports a light pipe providing a drive status indicator, located on the backplane, to be viewable from the front of the chassis.

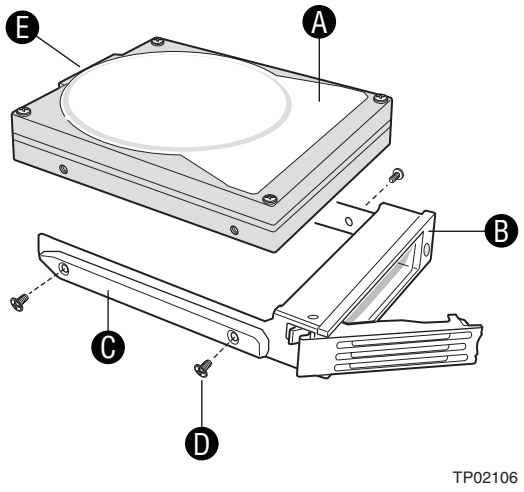


Figure 29. Hard Drive Tray Assembly

A. Hard Drive
B. Drive Carrier
C. Side Rail
D. Mounting Screw
E. Hard Drive Connector

[1] Default 5 Hard Drives + one optional 6Th Hard Drive using Flex Bay

5.3 Optional Tape Drive or 6th Hard Drive Flex Bay

For system configurations that require either a Tape Drive or a 6th hard disk drive, a dual purpose drive bay is provided. By default this drive bay is covered by two face plates as shown in the following diagram. The drive bay is located next to the control panel.

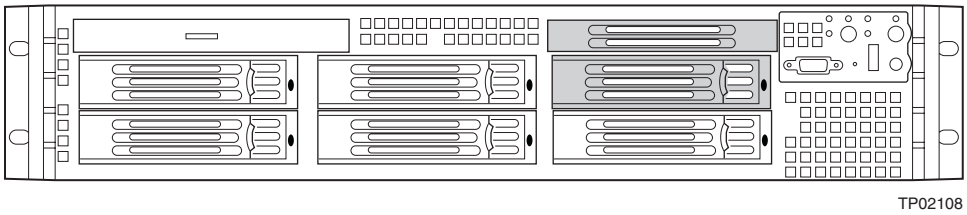


Figure 30. Optional 6th Hard Drive (Front View)

To configure a 6th hard drive, the lower face plate is removed and the 6th hard drive accessory kit is installed (product order code – ASR2500SIXDRV). This kit includes a backplane board insert, power cable, and drive carrier.

To install a 3.5” tape drive, both face plates are removed and the optional tape drive kit is installed (product order codes – ASR2500SATAPE or ADRTAPEKIT). Both tape drive kits include tape drive mounting tray and necessary cables.

Note: To remove the tape drive tray from the chassis, a spring latch located inside the chassis on the back right side of the carrier must be released to allow the drive tray to slide free. Do not attempt to pull out the drive tray without first releasing the spring latch. Doing so may damage the plastic faceplate.

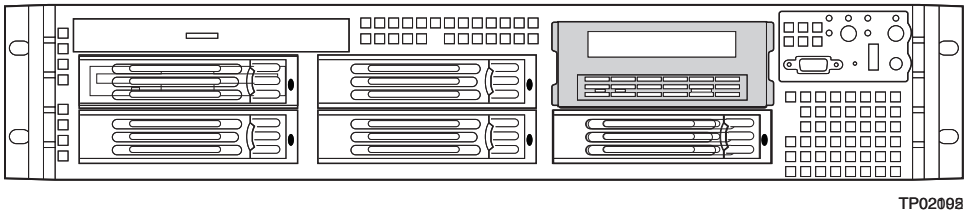


Figure 31. Optional Tape Drive (Front View)

5.4 Mid-plane Options

New to this generation of high density server platform is the concept of the mid-plane. The mid-plane is the interconnect between the server board and both the hot-swap backplane and control panel. It is also used to determine which hard drive technology is to be supported. Two different Mid-plane options are available for this platform 1) a passive mid-plane capable of supporting SATA ports from the server board or SAS using ports from an add-in card; 2) an active SAS / SAS RAID mid-plane. This section will describe the hard drive interface support of each of the mid-plane boards.

5.4.1 Passive Mid-plane

The passive mid-plane is used as an interconnect, routing drive control signals from either the on-board SATA ports of the baseboard or SAS/SATA ports from an add-in card to the hot-swap backplane. The hard drive controller signals are cabled to the mid-plane which then routes the signals to the hot-swap backplane through two edge connectors that plug directly into it. See Table 22. Mid-plane-to-Backplane Card Edge Connector #1 Pin-out and Table 23. Mid-plane-to-Backplane Card Edge Connector #2 Pin-out.

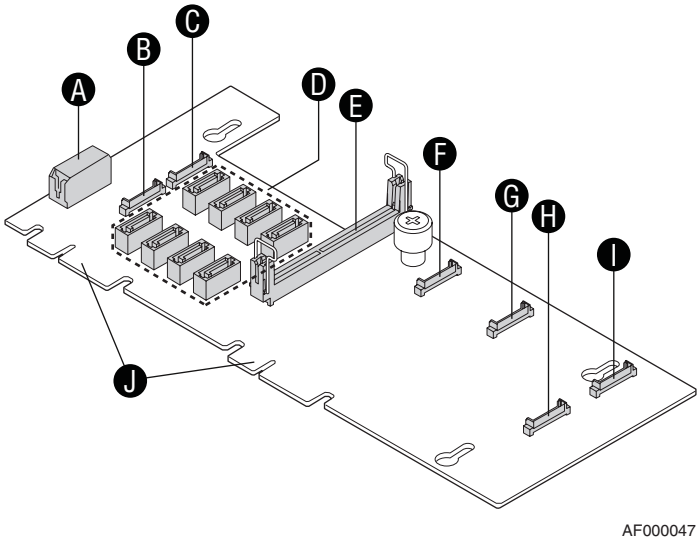


Figure 32. Passive Mid-plane Board

A	Power Connector	F	Fan 4 Connector
B	Fan 6 Connector	G	Fan 3 Connector
C	Fan 5 Connector	H	Fan 1 Connector
D	SAS/SATA Connectors	I	Fan 2 Connector
E	Bridge Board Connector	J	Backplane Connector

5.4.2 Active Mid-plane with Intel® SAS /SAS RAID Support

The active mid-plane is used to provide SAS / SAS RAID support. It has integrated on to it an Intel IOP80333 IO processor and an LSI* LSLSAS1068 3Gb/s SAS controller. Together they provide support for up to six SAS drives in this chassis. By default, this mid-plane option provides software RAID levels 0, 1, and 10 utilizing Intel® Embedded RAID Technology II. With the installation of optional RAID enablement devices, the mid-plane can support hardware RAID levels 0, 1, 5, 10, and 50. The mid-plane attaches to the hot-swap backplane by two card edge connectors which eliminates the need for any hard drive cables. The following sub-sections describe the board level SAS / SAS RAID functionality.

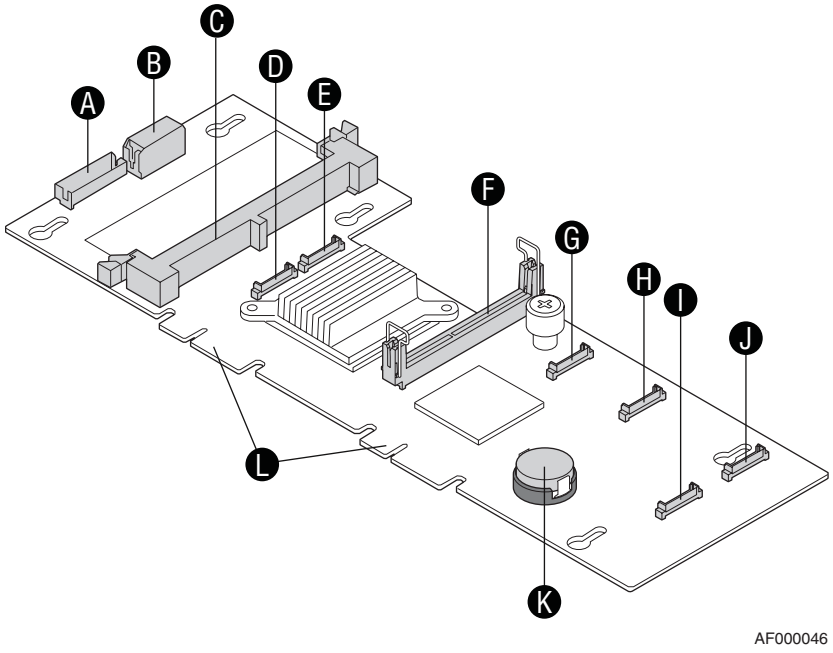


Figure 33. Active Mid-plane with SAS / SAS RAID Support

A	RAID Activation Key Connector	G	Fan 4 Connector
B	Power Connector	H	Fan 3 Connector
C	Mini-DIMM Connector	I	Fan 1 Connector
D	Fan 6 Connector	J	Fan 2 Connector
E	Fan 5 Connector	K	Battery
F	Bridge Board Connector	L	Backplane Connector

5.4.2.1 Architectural Overview

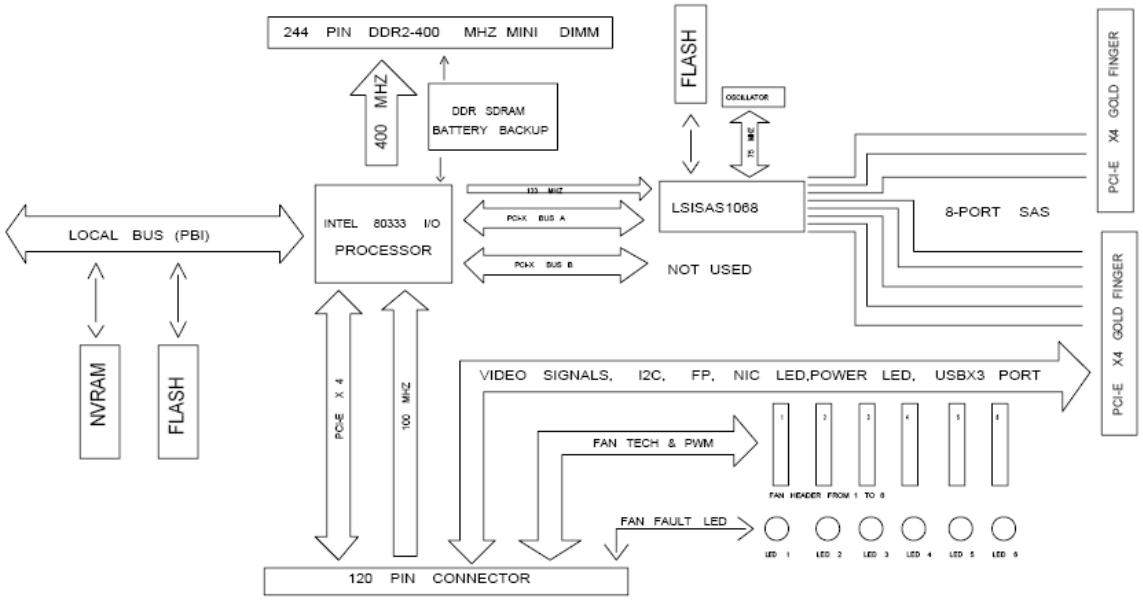


Figure 34. Architecture Overview

5.4.2.2 x4 PCIe* Card Edge Interfaces

Two x4 PCIe* card edges are used to connect the active mid-plane to the hot-swap backplane. See Table 22. Mid-plane-to-Backplane Card Edge Connector #1 Pin-out and Table 23. Mid-plane-to-Backplane Card Edge Connector #2 Pin-out for details. The use of card edge connectors to the back plane eliminates all hard drive cabling.

5.4.2.3 IOP80333 IO processor

The Intel 80333 IO processor is a multi-function device that integrates the Intel Xscale® core with intelligent peripherals and two PCIe* to PCI-X* bridges. It will be connected to the server board 's x4 PCIe lane and serve as bridge for PCI-X 133MHz secondary bus. The IOP80333 also includes fully functional RAID support.

5.4.2.4 LSI* LSISAS1068 SAS Controller

The LSI* LSISAS1068 controller resides on the Channel A PCI-X bus of the IOP80333 supporting transfer rates of up to 3GB/s. It includes an Address Translation Unit (ATU) supporting transactions between PCI address space and 80333 address space. Address translation for the ATU is controlled through programmable registers accessible from both the PCI interface and the Intel Xscale® core. The LSISAS1068 controller includes its own Flash ROM and NVSRAM to support SAS only software RAID. Software RAID Levels supported include 0, 1, and 10.

5.4.2.5 Optional Hardware RAID Support

The active mid-plane supports options to provide full hardware RAID support. Options required to enable hardware RAID support include an Intel® RAID Activation Key (product order code -

AXXRAK18E) and installation of a Mini-DIMM for Intel RAID Cache support. To protect from data loss during an unexpected power loss event, an Intel® RAID Smart Battery Backup module (AXXRSBBU3) is also supported. Hardware RAID levels supported include 0, 1, 5, 10, and 50.

5.4.2.5.1 Intel® RAID Activation Key

The Intel® RAID Activation Key enables the full intelligent SAS Hardware RAID solution engineered around the Intel® 80333 I/O Processor @ 500MHz. The activation key plugs directly in to a connector (J1A10) on the mid-plane board. With no RAID activation key installed, only SAS Software RAID levels 0, 1, and 10 are supported.

5.4.2.5.2 Intel RAID Cache support

To further enable support for hardware RAID, the active mid-plane provides a 244-pin mini-DIMM connector (J8C1), supporting a single registered ECC non-parity DDR2-400 MHz Mini-DIMM to provide Intel RAID cache. Mini-DIMM capacities supported range from 128MB to 1GB.

Note: See the *Intel® Server Board S5000PAL Tested Memory List* for a list of Intel validated mini-DIMMs.

5.4.2.5.3 Intel® RAID Smart Battery Backup Module

With an Intel® RAID Smart Battery Backup module installed, data loss is prevented when data is still present in the RAID Cache Module and power is unexpectedly lost. Depending on the cache module capacity used, the battery backup unit can provide 48 to 72 hours of battery backup power to allow data stored in the RAID cache to be processed. A 2x10 connector (J9A2) is used to attach the battery backup unit to the mid-plane. See Table 24. Active Mid-plane SAS RAID Battery Backup Connector Pin-out for details.

5.5 Hot-Swap SAS/SATA Backplane

The chassis supports a multifunctional SAS/SATA backplane with the following features:

- Vitesse* VSC410 enclosure management controller
    - External non-volatile Flash ROM
    - Four I^2C interfaces
    - Compliance with SCSI Accessed Fault Tolerant Enclosures (SAF-TE) specification
    - Compliance with Intelligent Platform Management Interface (IPMI)
- Five SAS/SATA compatible hot-swap hard drive connectors
- Designed to support an optional 6^{th} hard drive, or power for an optional tape drive.
- Hard Drive Status and Fault LEDs for each hard drive connector
- Card edge connectors for most interconnects, including:
    - Mid-plane
    - Control Panel
    - Slim-line IDE Optical Drive
- Temperature Sensor
- FRU EEPROM
- One 2x4-pin Power Connector

-

5.5.1 SAS/SATA Backplane Layout

The hot-swap backplane installs on the back side of the hot-swap drive bay inside the chassis. Alignment features on the chassis and backplane assembly make for easy tool-less installation. The following diagram shows the layout of components and connectors found on the board.

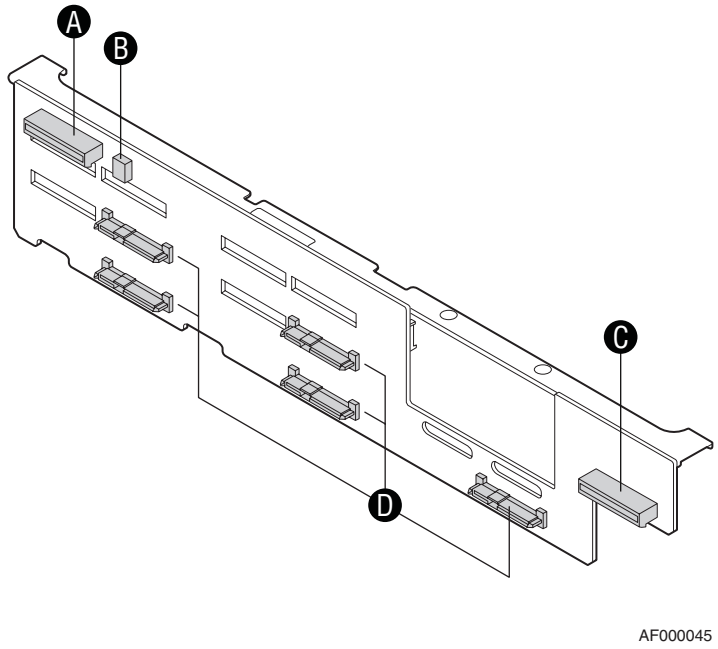


Figure 35. Hot-swap SAS/SATA Backplane (Front Side View)

A	Slim-line Optical Drive Connector	C	Control Panel Connector
B	Slim-line USB Floppy Connector	D	SAS/SATA Hot Swap Connectors

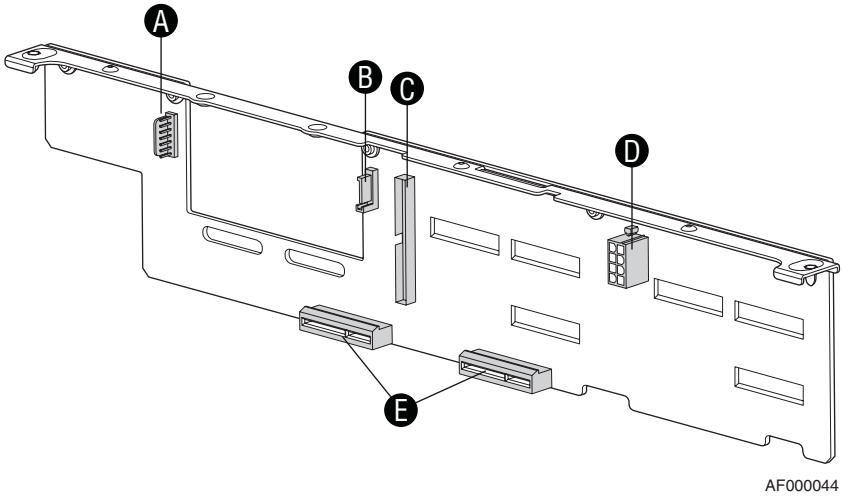


Figure 36. Hot-swap SAS/SATA Backplane (Back Side View)

A	Power Connector (for 6th Hard Drive or Tape Drive)	D	Power Connector
B	SAS/SATA Connector (for 6th Hard Drive or SATA Tape Drive)	E	Midplane Connectors
C	IDE Connector		

Notes: To prevent the backplane from flexing when installing or removing hard drives from the drive bay, make sure the mid-plane is securely fastened and the system top cover is in place.

Make sure all system boards, peripherals, and cables are detached from the backplane before removing the backplane from the system. Failure to detach components from the backplane before removal may result in component damage.

5.5.2 SAS/SATA Backplane Functional Architecture

The figure below shows the functional blocks of the SAS/SATA backplane.

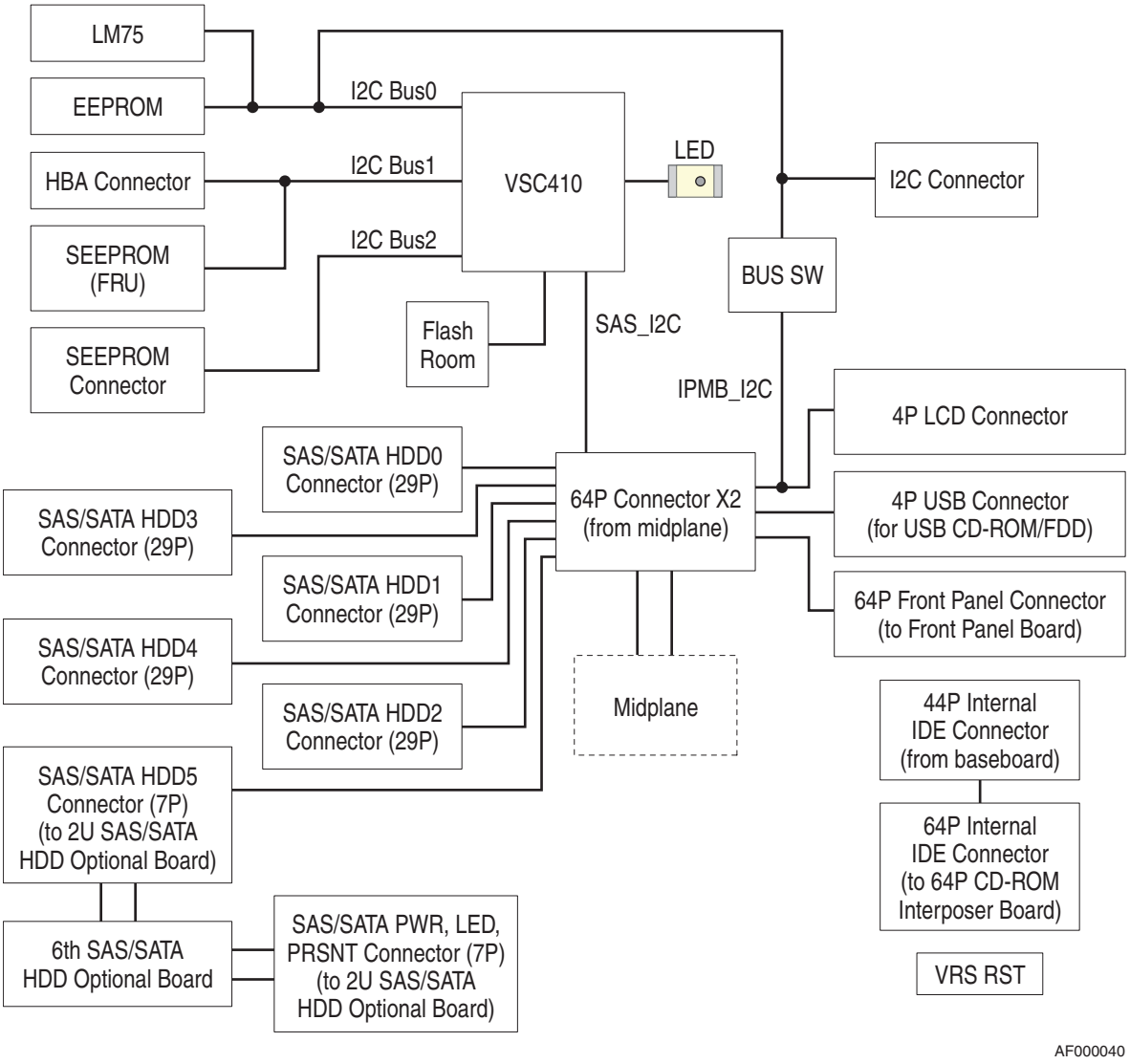


Figure 37. SAS/SATA Backplane Functional Block Diagram

5.5.2.1 Enclosure Management Controller

The backplane utilizes the features of the Vitesse* VSC410 to implement several enclosure management functions. The chip provides in-band SAF-TE and SES management and utilizes the four I^2C interfaces listed below.

1. I2C bus 0 is connected to an EEPROM which stores configuration and FRU data
2. I2C bus 1 is connected to an LM75 temperature sensor
3. I2C bus 2 is connected to an IPMB bus from the server board.
4. I2C bus 3 is connected to the LSISAS1068 SAS controller.

5.5.2.2 Hard Drive Activity and Fault LEDs

The backplanes support an activity/fault LED for each of the hard drive connectors. The LED will illuminate green for activity or amber for a drive fault. The green activity LED is driven by the SAS/SATA hard disk drive directly. The amber fault LED is driven by the VSC410* management controller whenever a fault condition is detected. When the drive is used in a RAID configuration, the RAID controller will have control over the fault LED and it may exhibit different behavior.

Table 40. Hard Drive LED Function Definitions

Status LED	Definition
GREEN	HDD Activity
AMBER	HDD Fail

The activity LED functionality is controlled directly by the hard drives. This causes the LED to function differently between SAS and SATA drives. The expected operation is outlined below.

Table 41. Hard Drive Activity LED Functionality

Condition	Drive Type	Behavior
Power on with no drive activity	SAS	Ready LED stays on
	SATA	Ready LED stays off
Power on with drive activity	SAS	Ready LED blinks off when processing a command
	SATA	Ready LED blinks on when processing a command
Power on and drive spun down	SAS	Ready LED stays off
	SATA	Ready LED stays off
Power on and drive spinning up	SAS	Ready LED blinks*
	SATA	Ready LED stays off

5.5.2.3 Optional 6th Hard Drive

The backplane is capable of supporting a 6th hot-swap SAS/SATA hard drive with the addition of an optionally installed backplane add-in board. The 6th drive add-in board assembly consists of a PCB with power and interface connectors, and a mounting bracket allowing for the add-in card to slide into a fitted cut out on the existing backplane.

6. Standard Control Panel

The standard control panel supports several push buttons and status LEDs, along with USB and video ports to centralize system control, monitoring, and accessibility to within a common compact design.

The control panel assembly comes pre-assembled and is modular in design. The control panel assembly module slides into a slot on the front of the chassis and is blind mated with a slot connector on the backplane. It is not hot-swappable.

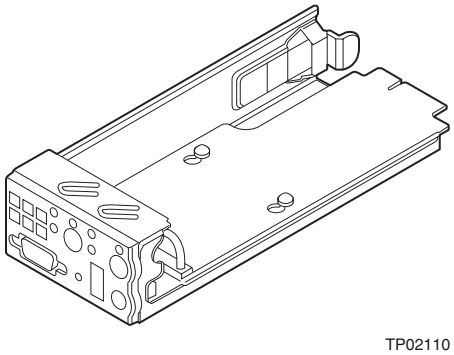


Figure 38. Standard Control Panel Assembly Module

6.1 Control Panel Buttons

The standard control panel assembly houses several system control buttons. Each of their functions is listed in the table below.

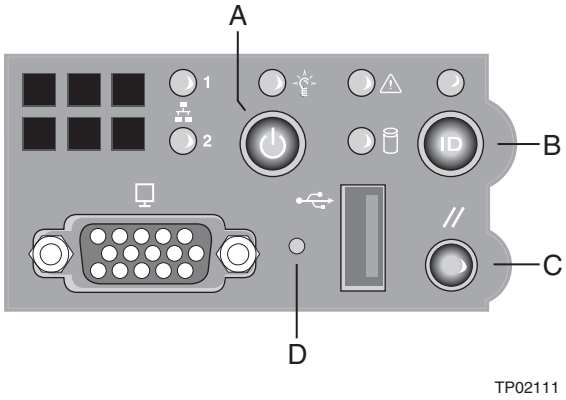


Figure 39. Control Panel Buttons

Table 42. Control Button and Intrusion Switch Functions

Reference	Feature	Function
A	Power / Sleep Button	Toggles the system power on/off. This button also functions as a Sleep Button if enabled by an ACPI-compliant operating system.
B	ID Button	Toggles the front panel ID LED and the server board ID LED on/off. The server board ID LED is visible through the rear of the chassis and allows you to locate the server you're working on from behind a rack of servers.
C	Reset Button	Reboots and initializes the system.
D	NMI Button	Pressing the recessed button with a paper clip or pin puts the server in a halt state for diagnostic purposes and allows you to issue a non-maskable interrupt. After issuing the interrupt, a memory download can be performed to determine the cause of the problem.

6.2 Control Panel LED Indicators

The control panel houses six LEDs, which are viewable with or without the front bezel to display the system's operating state.

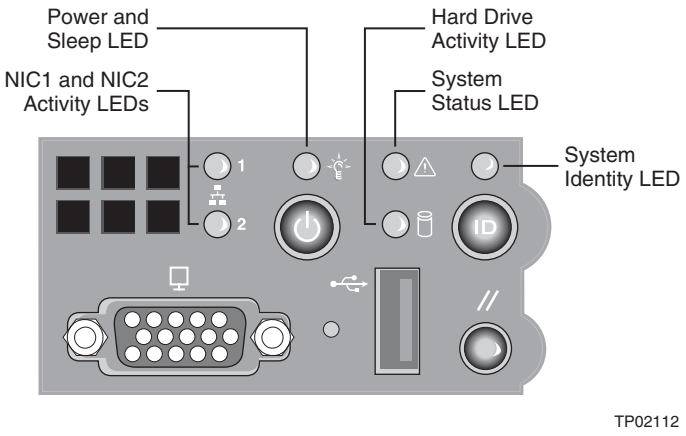


Figure 40. Control Panel LEDs

The following table identifies each LED and describes their functionality.

Table 43. Control Panel LED Functions

LED	Color	State	Description
NIC1 / NIC2 Activity	Green	On	NIC Link
	Green	Blink	NIC Activity
Power / Sleep (on standby power)	Green	On	Legacy power on / ACPI S0 state
		Blink [1,4]	Sleep / ACPI S1 state
	Off	Off	Power Off / ACPI S4 or S5 state
System Status (on standby power)	Green/Amber	Alternating Blink	Pre DC Power On – 15-20 second BMC Initialization
	Green	On	Running / normal operation
		Blink [1,2]	Degraded
	Amber	On	Critical or non-recoverable condition.
		Blink [1,2]	Non-critical condition.
	Off	Off	POST / system stop.
Disk Activity	Green	Random blink	Provides an indicator for disk activity.
	Off	Off [3]	No hard disk activity
System Identification	Blue	On	Identify active via command or button.
	Off	Off	No Identification.

Notes:
1. Blink rate is ~1 Hz with at 50% duty cycle.
2. The amber status takes precedence over the green status. When the amber LED is on or blinking, the green LED is off.
3. Also off when the system is powered off (S4/S5) or in a sleep state (S1).
4. The power LED sleep indication is maintained on standby by the chipset. If the system is powered down without going through BIOS, the LED state in effect at the time of power off will be restored when the system is powered on until the BIOS clears it. If the system is not powered down normally, it is possible that the Power LED will be blinking at the same time that the system status LED is off due to a failure or configuration change that prevents the BIOS from running.

The current limiting resistors for the power LED, the system fault LED, and the NIC LEDs are located on the server board.

6.2.1 Power / Sleep LED

Table 44. SSI Power LED Operation

State	Power Mode	LED	Description
Power Off	Non-ACPI	Off	System power is off, and the BIOS has not initialized the chipset.
Power On	Non-ACPI	On	System power is on, but the BIOS has not yet initialized the chipset.
S5	ACPI	Off	Mechanical is off, and the operating system has not saved any context to the hard disk.
S4	ACPI	Off	Mechanical is off. The operating system has saved context to the hard disk.
S3-S1	ACPI	Slow blink 1	DC power is still on. The operating system has saved context and gone into a level of low-power state.
S0	ACPI	Steady on	System and the operating system are up and running.

Notes:
1. Blink rate is ~ 1Hz with at 50% duty cycle.

6.2.2 System Status LED

Table 45. Control Panel LED Operation

Color	State	Criticality	Description
Off	N/A	Not ready	AC power off
Green/ Amber	Alternating Blink	Not ready	Pre DC Power On – 15-20 second BMC Initialization when AC is applied to the server. Control Panel buttons are disabled until BMC initialization is complete.
Green	Solid on	Ok	System booted and ready
Green	Blink	Degraded	System degraded Unable to use all of the installed memory (more than one DIMM installed). Correctable errors over a threshold of 10 and migrating to a spare DIMM (memory sparing). This indicates that the user no longer has spared DIMMs indicating a redundancy lost condition. Corresponding DIMM LED should light up. In mirrored configuration, when memory mirroring takes place and system loses memory redundancy. This is not covered by (2). Redundancy loss such as power-supply or fan. This does not apply to non-redundant sub-systems. PCIe* link errors CPU failure / disabled – if there are two processors and one of them fails Fan alarm – Fan failure. Number of operational fans should be more than minimum number needed to cool the system Non-critical threshold crossed – Temperature and voltage
Amber	Blink	Non-critical	Non-fatal alarm – system is likely to fail Critical voltage threshold crossed VRD hot asserted Minimum number of fans to cool the system not present or failed In non-sparing and non-mirroring mode if the threshold of ten correctable errors is crossed within the window

Amber	Solid on	Critical, non-recoverable	Fatal alarm – system has failed or shutdown DIMM failure when there is one DIMM present, no good memory present Run-time memory uncorrectable error in non-redundant mode IERR signal asserted Processor 1 missing Temperature (CPU ThermTrip, memory TempHi, critical threshold crossed) No power good – power fault Processor configuration error (for instance, processor stepping mismatch)

6.2.2.1 System Status LED – BMC Initialization

When AC power is first applied to the system and 5V-STBY is present, the BMC controller on the server board requires 15-20 seconds to initialize. During this time, the system status LED will blink, alternating between amber and green, and the power button functionality of the control panel is disabled, preventing the server from powering up. Once BMC initialization has completed, the status LED will stop blinking and the power button functionality is restored and can be used to turn on the Server.

6.2.3 Drive Activity LED

The drive activity LED on the front panel indicates drive activity from the onboard hard disk controllers. The Intel® Server Board S5000PAL also provides a header giving access to this LED for add-in controllers.

6.2.4 System Identification LED

The blue system identification LED is used to help identify a system for servicing. This is especially useful when the system is installed when in a high density rack or cabinet that is populated with several similar systems.

The blue system ID LED can be illuminated using either of two mechanisms.

- By pressing the system ID button on the system control panel, the ID LED will display a solid blue color until the button is pressed again.

- By issuing the appropriate hex IPMI chassis identify value, the ID LED will either blink blue for 15 seconds and turn off or will blink indefinitely until the appropriate hex IPMI chassis identify value is issued to turn it off.

6.3 Control Panel Connectors

The control panel has two external I/O connectors:

- One USB port
- One VGA video port

The following tables provide the pin-outs for each connector.

Table 46. External USB Connectors (J1B1)

Pin #	Description
1	PWR_FP_USB2
2	USB_DN2_FP_R
3	USB_DP2_FP_R
4	GND
5	GND
6	GND
7	GND

Table 47. Video Connector (J1A1)

Description	Pin #	Pin #	Description
VGA_RED	1	9	GND
VGA_GREEN	2	10	GND
VGA_BLUE	3	11	Unused
Unused	4	12	VGA_DDCDAT
GND	5	13	VGA_HSYNC_L
GND	6	14	VGA_VSYNC_L
VGA_INUSE_L	7	15	VGA_DDCCLK
GND	8	16	GND
		17	GND

If a monitor is connected to the control panel video connector, the rear video port on the server board will be disabled and the control panel video will be enabled. The video source is the same for both connectors and is switched between the two, with the control panel having priority over the rear video. This provides for easy front accessibility to the server.

6.4 Internal Control Panel Interconnect

All control panel signals are directed through a single 64-pin card edge connector eliminating the need for any cables. When installed into the chassis control panel bay, the control panel card edge connector is blind mated with a slot connector on the backplane.

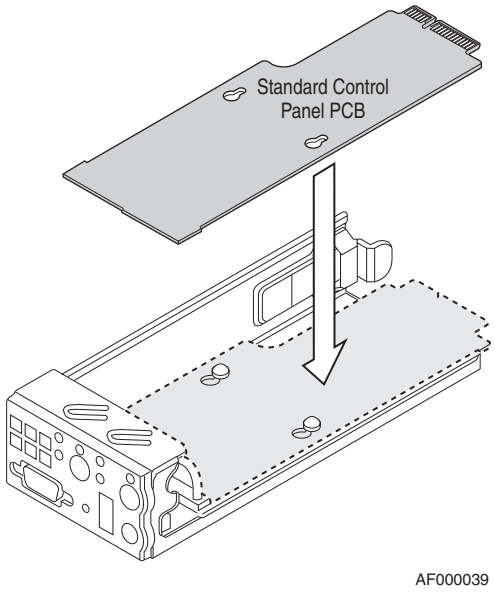


Figure 41. Standard Control Panel PCB

The following table defines the pin-out for the 64-pin edge connector.

Table 48. 64-pin Control Panel Connector (J6B1)

PIN	SIGNAL NAME	PIN	SIGNAL NAME
A1	GND	B1	1_WIRE_BUS
A2	VGA_VSYNC_FP_L	B2	P5V
A3	GND	B3	P5V
A4	VGA_HSYNC_FP_L	B4	P5V
A5	GND	B5	VGA_INUSE_L
A6	VGA_BLUE_FP	B6	GND
A7	GND	B7	P5V_STBY
A8	VGA_GREEN_FP	B8	GND
A9	GND	B9	FAULT_LED_5VSB
A10	VGA_RED_FP	B10	GND
A11	GND	B11	FP_SYS_FLT_LED1_R_L
A12	GND	B12	FP_ID_SW_L
A13	FP_RST_BTN_L	B13	FP_ID_LED_R_L
A14	GND	B14	NC_IPMB_5VSB_SDA
A15	NC_FP_CHASSIS_L	B15	NC_IPMB_5VSB_SCL
A16	GND	B16	GND
A17	BP_I2C_5V_SDA	B17	NIC1_ACT_LED_L
A18	BP_I2C_5V_SCL	B18	NIC1_LINK_LED_R_L
A19	GND	B19	FP_PWR_BTN_L
A20	FP_NMI_BTN_L	B20	PWR_LED_5VSB
A21	GND	B21	HDD_LED_P3V3_A
A22	USB_DP2_FP	B22	GND
A23	USB_DN2_FP	B23	GND
A24	GND	B24	NIC2_ACT_LED_L
A25	GND	B25	NIC2_LINK_LED_R_L
A26	PWR_FP_USB2	B26	HDD_FAULT_LED_R_L
A27	PWR_FP_USB3	B27	HDD_LED_ACT_R_L
A28	GND	B28	FP_PWR_LED_R_L
A29	GND	B29	FP_SYS_FLT_LED2_R_L
A30	USB_DP3_FP	B30	GND
A31	USB_DN3_FP	B31	GND
A32	GND	B32	NC_RST_P6_PWRGOOD

7. Intel® Local Control Panel

The Intel® Local Control Panel utilizes a combination of control buttons, LEDs, and LCD display to provide system accessibility, monitoring, and control functions. The pre-assembled module slides into a slot on the front of the chassis where a card edge connector is blind mated to a matching slot edge connector on the backplane eliminating any cable attachments. The Intel® Local Control Panel module is designed so that it can be adjusted for use with or without an outer front bezel.

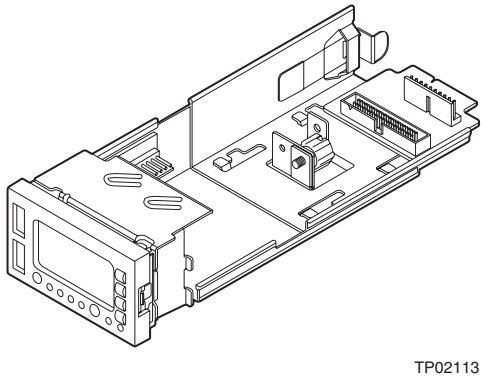


Figure 42. Intel® Local Control Panel Assembly Module

The following diagram provides an overview of the control panel features.

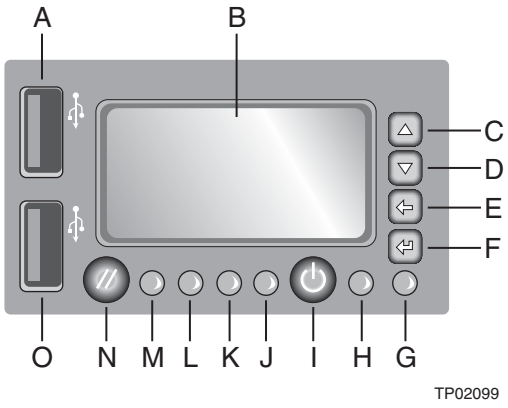


Figure 43. Intel® Local Control Panel Overview

A	LCD Display	I	System Status LED
B	LCD Menu Control Button – Up	J	NIC 2 Activity LED
C	LCD Menu Control Button – Down	K	NIC 1 Activity LED
D	LCD Menu Control Button – Previous Option	L	Hard Drive Activity LED
E	LCD Menu Control Button – Previous Page	M	System Reset Button
F	ID LED	N	USB 2.0 Port
G	Power LED	O	NMI Button (Tool Required)
H	System Power Button	P	USB 2.0 Port

7.1 LED Functionality

The following table identifies each LED and describes their functionality.

Table 49. Control Panel LED Functions

LED	Color	State	Description
NIC1 / NIC2 Activity	Green	On	NIC Link
	Green	Blink	NIC Activity
Power / Sleep (on standby power)	Green	On	Legacy power on / ACPI S0 state
		Blink [1,4]	Sleep / ACPI S1 state
	Off	Off	Power Off / ACPI S4 or S5 state
System Status (on standby power)	Green/Amber	Alternating Blink	Pre DC Power On – 15-20 second BMC Initialization
	Green	On	Running / normal operation
		Blink [1,2]	Degraded
	Amber	On	Critical or non-recoverable condition.
		Blink [1,2]	Non-critical condition.
	Off	Off	POST / system stop.
Disk Activity	Green	Random blink	Provides an indicator for disk activity.
	Off	Off [3]	No hard disk activity
System Identification	Blue	On	Identify active via command or button.
	Off	Off	No Identification.

Notes:

1. Blink rate is ~1 Hz with at 50% duty cycle.
2. The amber status takes precedence over the green status. When the amber LED is on or blinking, the green LED is off.
3. Also off when the system is powered off (S4/S5) or in a sleep state (S1).
4. The power LED sleep indication is maintained on standby by the chipset. If the system is powered down without going through BIOS, the LED state in effect at the time of power off will be restored when the system is powered on until the BIOS clears it. If the system is not powered down normally, it is possible that the Power LED will be blinking at the same time that the system status LED is off due to a failure or configuration change that prevents the BIOS from running.

The current limiting resistors for the power LED, the system fault LED, and the NIC LEDs are located on the Intel® Server Board S5000PAL.

7.1.1 Power / Sleep LED

Table 50. SSI Power LED Operation

State	Power Mode	LED	Description
Power Off	Non-ACPI	Off	System power is off, and the BIOS has not initialized the chipset.
Power On	Non-ACPI	On	System power is on, but the BIOS has not yet initialized the chipset.
S5	ACPI	Off	Mechanical is off, and the operating system has not saved any context to the hard disk.
S4	ACPI	Off	Mechanical is off. The operating system has saved context to the hard disk.
S3-S1	ACPI	Slow blink 1	DC power is still on. The operating system has saved context and gone into a level of low-power state.
S0	ACPI	Steady on	System and the operating system are up and running.

Notes:
1. Blink rate is ~ 1Hz with at 50% duty cycle.

7.1.2 System Status LED

Table 51. Control Panel LED Operation

Color	State	Criticality	Description
Off	N/A	Not ready	AC power off
Green/ Amber	Alternating Blink	Not ready	Pre DC Power On – 15-20 second BMC Initialization when AC is applied to the server. Control Panel buttons are disabled until BMC initialization is complete.
Green	Solid on	Ok	System booted and ready
Green	Blink	Degraded	System degraded Unable to use all of the installed memory (more than one DIMM installed). Correctable errors over a threshold of 10 and migrating to a spare DIMM (memory sparing). This indicates that the user no longer has spared DIMMs indicating a redundancy lost condition. Corresponding DIMM LED should light up. In mirrored configuration, when memory mirroring takes place and system loses memory redundancy. This is not covered by (2). Redundancy loss such as power-supply or fan. This does not apply to non-redundant sub-systems. PCIe link errors CPU failure / disabled – if there are two processors and one of them fails Fan alarm – Fan failure. Number of operational fans should be more than minimum number needed to cool the system Non-critical threshold crossed – Temperature and voltage
Amber	Blink	Non-critical	Non-fatal alarm – system is likely to fail Critical voltage threshold crossed VRD hot asserted Minimum number of fans to cool the system not present or failed In non-sparing and non-mirroring mode if the threshold of ten correctable errors is crossed within the window

Amber	Solid on	Critical, non-recoverable	Fatal alarm – system has failed or shutdown DIMM failure when there is one DIMM present, no good memory present Run-time memory uncorrectable error in non-redundant mode IERR signal asserted Processor 1 missing Temperature (CPU ThermTrip, memory TempHi, critical threshold crossed) No power good – power fault Processor configuration error (for instance, processor stepping mismatch)

7.1.2.1 System Status LED – BMC Initialization

When AC power is first applied to the system and 5V-STBY is present, the BMC controller on the server board requires 15-20 seconds to initialize. During this time, the system status LED will blink, alternating between amber and green, and the power button functionality of the control panel is disabled, preventing the server from powering up. Once BMC initialization has completed, the status LED will stop blinking and the power button functionality is restored and can be used to turn on the server.

7.1.3 Drive Activity LED

The drive activity LED on the front panel indicates drive activity from the onboard hard disk controllers. The Intel® Server Board S5000PAL also provides a header giving access to this LED for add-in controllers.

7.1.4 System Identification LED

The blue system identification LED is used to help identify a system for servicing. This is especially useful when the system is installed when in a high density rack or cabinet that is populated with several similar systems.

The blue system ID LED can be illuminated using either of two mechanisms.

- By pressing the system ID button on the system control panel, the ID LED will display a solid blue color until the button is pressed again.

- By issuing the appropriate hex IPMI chassis identify value, the ID LED will either blink blue for 15 seconds and turn off or will blink indefinitely until the appropriate hex IPMI chassis identify value is issued to turn it off.

7.2 Intel® Local Control Panel Interconnects

The Intel® Local Control Panel module includes the control panel interface board and an interposer board. Connectors on the control panel interface board are cabled to matching connectors on the interposer board. When the pre-assembled control panel module is installed into the chassis, a card edge connector on the interposer card is blind mated with a slot edge connector on the backplane. This section will define the pin-out for each connector and header found on both the control panel interface board and interposer board.

- A 64-pin card edge connector on the interposer board is used to route signals to/from the backplane to the control panel interface board. The backplane is used as a conduit for communication to the server board.
- Signals from the card edge connector are routed to control panel interface board through matching 50-pin connectors on the interposer board and control panel interface board. The 50-pin connectors are attached using a small 50-pin flat cable.
- USB signals from the card edge connector are routed to the control panel interface board through matching 10-pin connectors on the interposer board and control panel interface board. The 10-pin connectors are attached using a small 10-pin round cable.
- A 4-pin IPMI header (not used).
- A 4-pin NMI/Temp Sensor header.

The following tables provide the pin-outs for each connector.

Table 52. 50-pin Control Panel Connector

PIN	SIGNAL NAME	PIN	SIGNAL NAME
A1	GND	B1	1_WIRE_BUS
A2	VGA_VSYNC_FP_L	B2	P5V
A3	GND	B3	P5V
A4	VGA_HSYNC_FP_L	B4	P5V
A5	GND	B5	VGA_INUSE_L
A6	VGA_BLUE_FP	B6	GND
A7	GND	B7	P5V_STBY
A8	VGA_GREEN_FP	B8	GND
A9	GND	B9	FAULT_LED_5VSB
A10	VGA_RED_FP	B10	GND
A11	GND	B11	FP_SYS_FLT_LED1_R_L
A12	GND	B12	FP_ID_SW_L
A13	FP_RST_BTN_L	B13	FP_ID_LED_R_L
A14	GND	B14	NC_IPMB_5VSB_SDA
A15	NC_FP_CHASSIS_L	B15	NC_IPMB_5VSB_SCL
A16	GND	B16	GND
A17	BP_I2C_5V_SDA	B17	NIC1_ACT_LED_L
A18	BP_I2C_5V_SCL	B18	NIC1_LINK_LED_R_L
A19	GND	B19	FP_PWR_BTN_L
A20	FP_NMI_BTN_L	B20	PWR_LED_5VSB
A21	GND	B21	HDD_LED_P3V3_A
A22	USB_DP2_FP	B22	GND
A23	USB_DN2_FP	B23	GND
A24	GND	B24	NIC2_ACT_LED_L
A25	GND	B25	NIC2_LINK_LED_R_L

PIN	SIGNAL NAME	PIN	SIGNAL NAME
A26	PWR_FP_USB2	B26	HDD_FAULT_LED_R_L
A27	PWR_FP_USB3	B27	HDD_LED_ACT_R_L
A28	GND	B28	FP_PWR_LED_R_L
A29	GND	B29	FP_SYS_FLT_LED2_R_L
A30	USB_DP3_FP	B30	GND
A31	USB_DN3_FP	B31	GND
A32	GND	B32	NC_RST_P6_PWRGOOD

Table 53. Internal USB Header

Pin #	Description
1	PWR_FP_USB2
2	PWR_FP_USB3
3	USB_DP2_FP
4	USB_DN2_FP
5	USB_DP3_FP
6	USB_DN3_FP
7	GND
8	GND
9	TP_USB0_P9
10	TP_USB0_P10

8. PCI Riser Cards and Assembly

The chassis supports different riser card options depending on the add-in card configuration desired. The riser assembly for the chassis is tool-less. Stand-offs on the bracket allow the riser cards to slide onto the assembly where a latching mechanism than holds each riser in place. Holding down the latch releases the risers for easy removal.

When re-inserting the riser assembly into the chassis, tabs on the back of the assembly should be aligned with slots on the back edge of the chassis. The tabs fit into the slots securing the riser assembly to the chassis when the top cover is in place.

The riser assembly provides two extraction levers to assist with riser assembly removal from the riser slots.

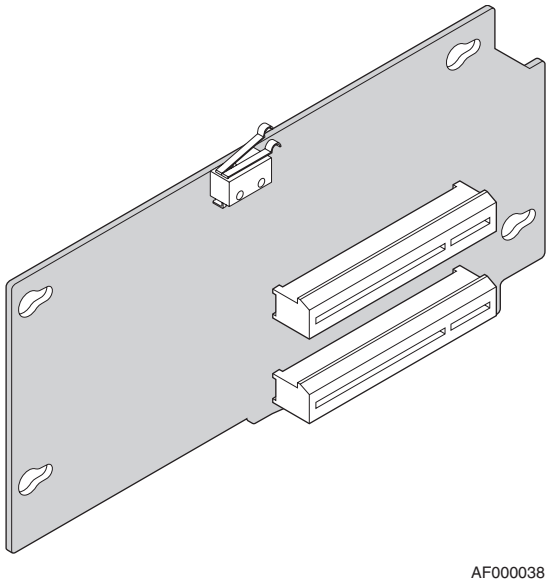


Figure 44. Low Profile PCIe* Riser

8.1 Riser Card Options

The Intel® Server Board S5000PAL has two riser slots capable of supporting riser cards for both 1U and 2U system configurations. Because of board placement resulting in different pin orientations, and expanded technology support associated with the full-height riser, the riser slots are not the same and require different riser cards.

The low profile riser slot (J5B1) utilizes a 98-pin connector. It is capable of supporting up to two low profile PCIe* add-in cards. The x8 PCIe bus can support bus speeds of up to 20Gb/S. The following table provides the supported bus throughput for the given riser card used and the number of add-in cards installed.

Low Profile Riser	1 add-in card	2 add-in cards
2U	X4	X4

Note: There are no population rules for installing a single low profile add-in card in the 2U low profile riser card; a single add in card can be installed in either PCI Express* slot. While each slot can accommodate a x8 card, each slot will only support x4 bus speeds.

The full height riser slot (J4F1) implements Intel® Adaptive Slot Technology. This 280-pin connector is capable of supporting riser cards that meet either the PCI-X* or PCI Express* technology specifications. The following tables show the maximum bus speed supported with different add-in card populations.

Full Height Riser PCI-X "Passive" (Product Order Code – ADRPCIXRIS)	1 add-in card	2 add-in cards	3 add-in cards
2U – 3 add-in card slots	Up to 100MHz in top PCI slot	Up to 100MHz using top and middle slots	66MHz

Note: For the 2U PCI-X* (passive) riser card, add-in cards should be installed starting with the top slot first, followed by the middle, and then the bottom. Any add-in card populated in the bottom PCI slot will cause the bus to operate at 66MHz.

Full Height Riser PCI-X "Active" (Product Order Code – ADRACTRIS)	1 add-in card	2 add-in cards	3 add-in cards
2U	Up to 133MHz	Up to 133MHz	Up to 133MHz

Note: Each PCI slot on the 2U PCI-X* (active) riser card operates on an independent PCI bus. Using an add-in card that operates below 133MHz will not affect the bus speed of the other PCI slots.

Full Height Riser PCI Express* (Product Order Code – ASR2500FHR)	1 add-in card	2 add-in cards	3 add-in cards
2U – 3 add-in card slots	Single PCIe* x4 in either slot or x8 in middle slot Or PCI-X* – Up to 133MHz in bottom slot	Single PCIe – x4 in either slot or x8 in middle slot and PCI-X – Up to 133MHz Or Dual PCIe – x4	Dual PCIe – x4 And PCI-X – Up to 133MHz

8.2 PCI Riser Card Mechanical Drawings

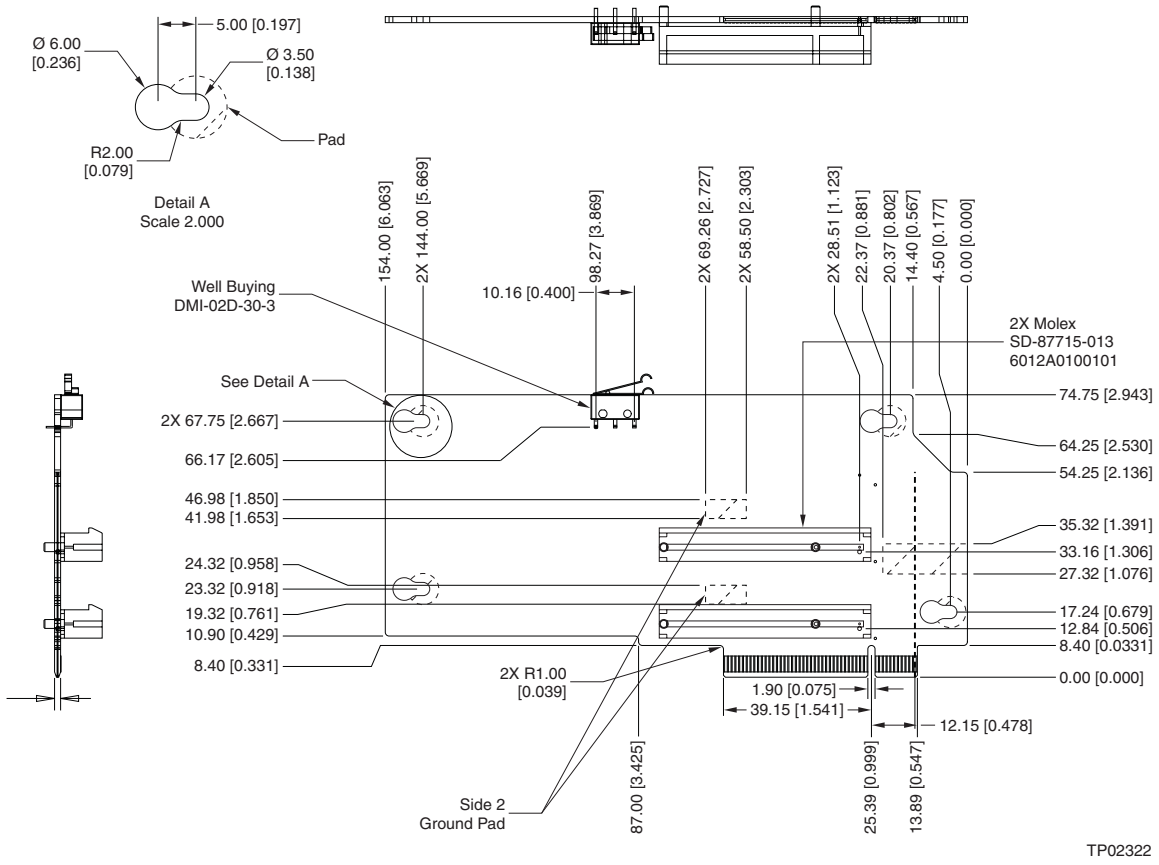
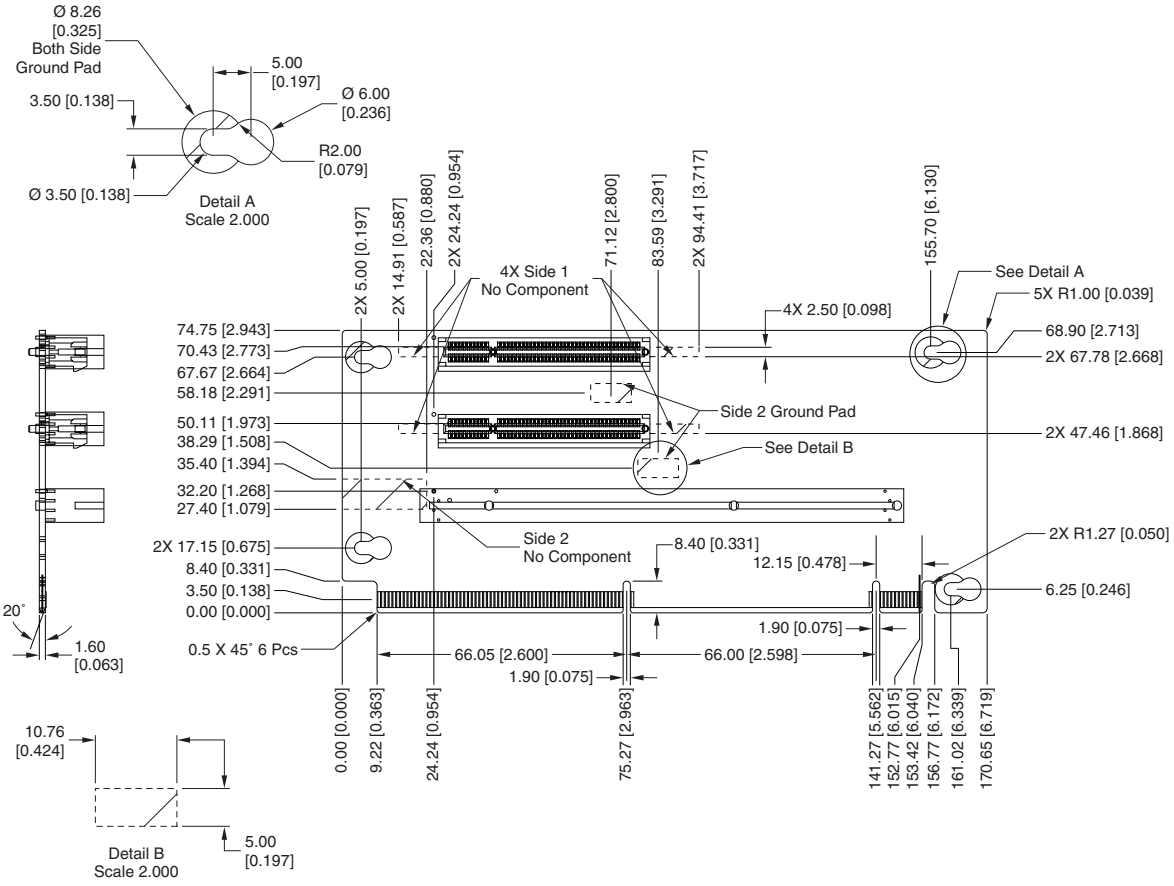


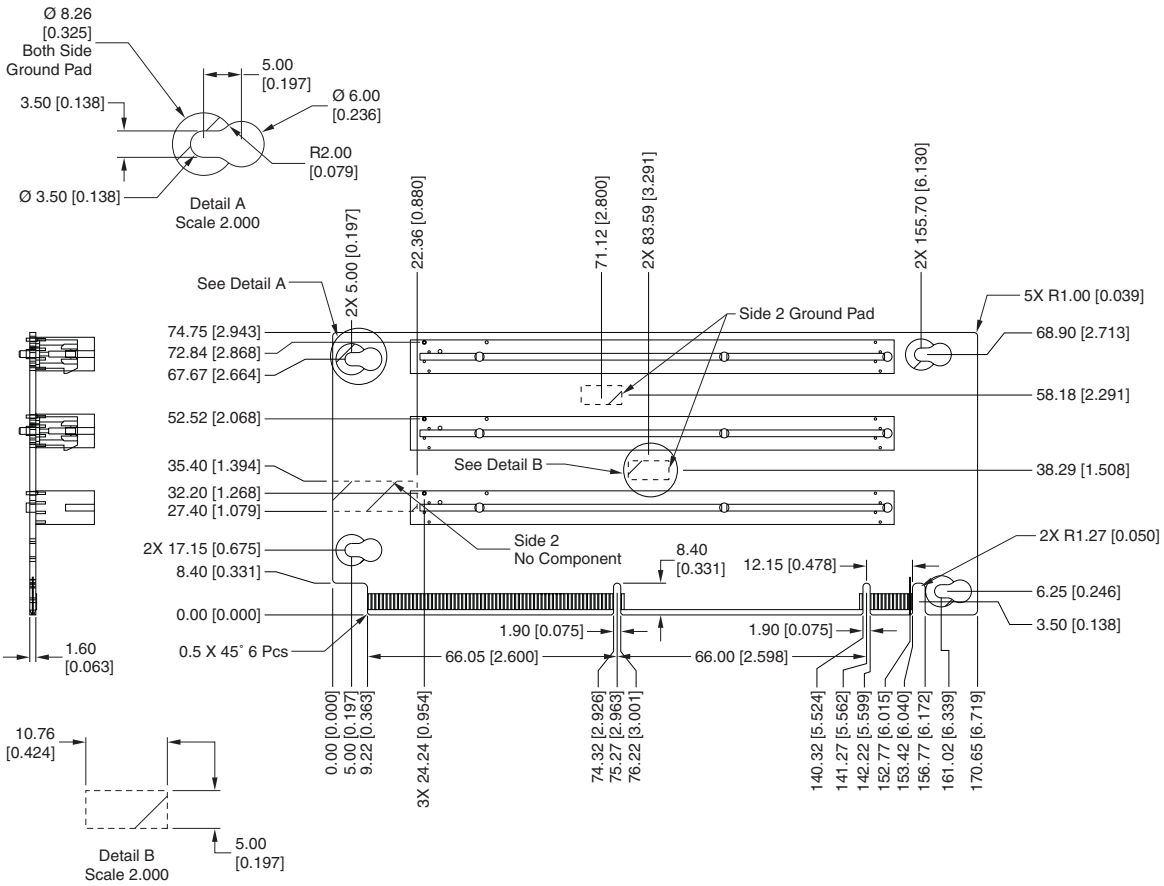
Figure 45. Low Profile Passive PCI Express* Riser Card



Notes:
1. PCB tolerance:
   A: 62 mil (1.58 mm) ± 7 mil
   B: 93 mil (2.36 mm) ± 9 mil
   C: 98 mil (2.49 mm) ± 9 mil
2. If there is needed:
   sheet 1: Board profile and mounting hole
   2: Pin location
   3: Constrain area on both sides
3. No indicated radii should be 2.00 mm

TP02320

Figure 46. Full Height PCI Express* Riser Card



Notes:
1. PCB tolerance:
   A: 62 mil (1.58 mm) ± 7 mil
   B: 93 mil (2.36 mm) ± 9 mil
   C: 98 mil (2.49 mm) ± 9 mil
2. If there is needed:
   sheet 1: Board profile and mounting hole
   2: Pin location
   3: Constrain area on both sides
3. No indicated radii should be 2.00 mm

TP02321

Figure 47. Full Height Passive PCI-X* Riser Card

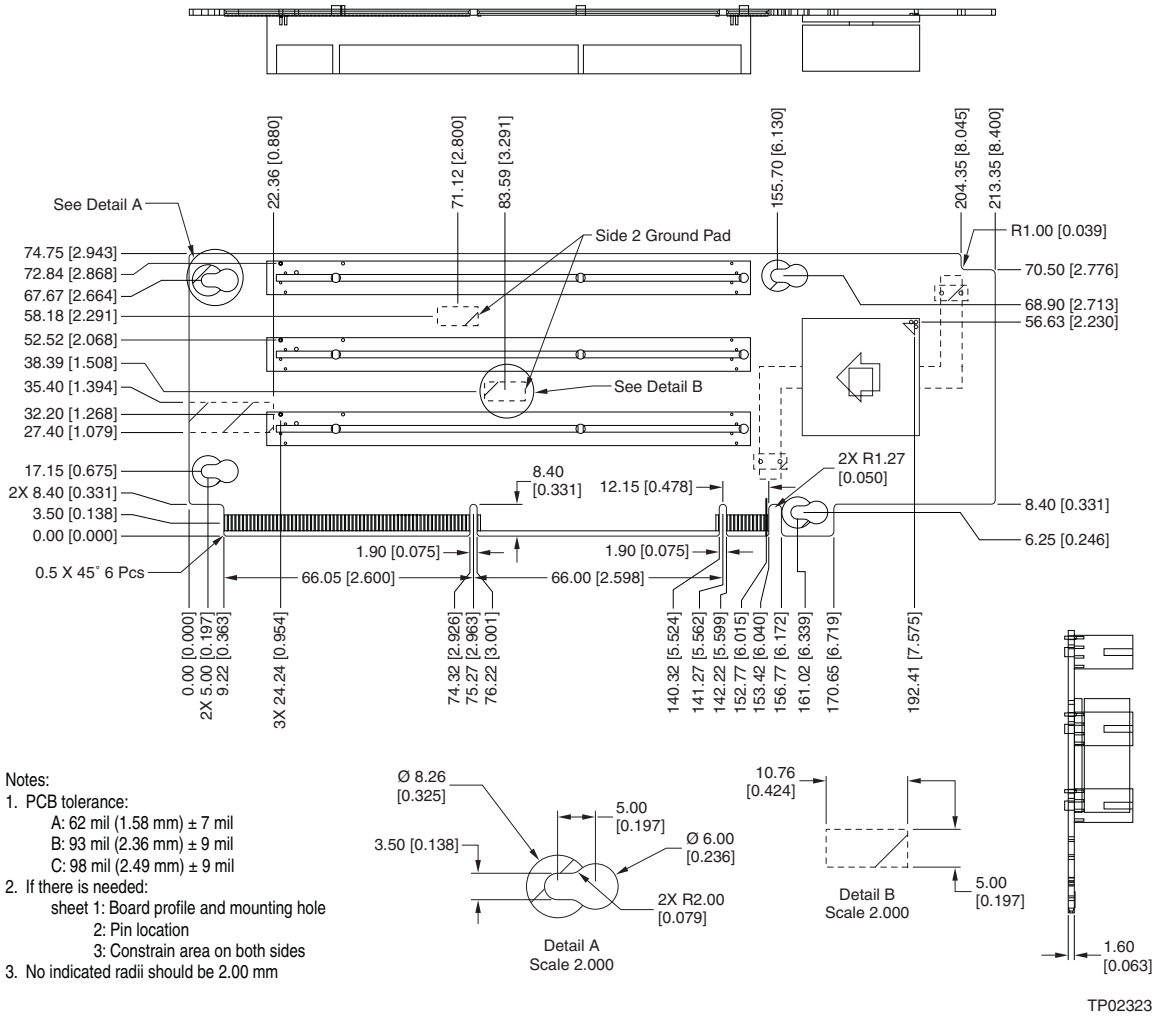


Figure 48. Full Height Active PCI-X* Riser Card

9. Supported Intel® Server Boards

The chassis is mechanically and functionally designed to support the Intel® Server Board S5000PAL and Intel® Server Board S5000XAL. The following sections provide an overview of the server board feature sets. The Technical Product Specification for the server board should be referenced for more detailed information.

9.1 Intel® Server Board S5000PAL / S5000XAL Feature Set

The Intel® Server Board S5000PAL and Intel® Server Board S5000XAL are monolithic printed circuit boards with features that were designed to support the high-density 1U and 2U server markets.

Feature	Description
Processors	771-pin LGA sockets supporting 1 or 2 Dual-Core Intel® Xeon® processors 5000 sequence, with system bus speeds of 667 MHz, 1066 MHz, or 1333 MHz
Memory	8 Keyed DIMM slots supporting fully buffered DIMM technology (FBDIMM) memory. 240-pin DDR2-533 and DDR2-677 FBDIMMs must be used.
Chipset	Intel® 5000 Chipset Family which includes the following components: Intel® 5000P Memory Controller Hub or Intel® 5000X Memory Controller Hub Intel® 6321ESB I/O Controller Hub[1] Note: Intel will only make available an OEM SKU of this server board using the Intel® 5000X Memory Controller Hub.

On-board Connectors/Headers	External connections:
	▪ Stacked PS/2* ports for keyboard and mouse
	▪ RJ45 Serial B port
	▪ Two RJ45 NIC connectors for 10/100/1000 Mb connections
	▪ Two USB 2.0 ports
	▪ Video Connector
	Internal connectors/headers:
	▪ One USB port header, capable of providing two USB 2.0 ports
	▪ One DH10 Serial A header
	▪ Six SATA ports via the ESB-2 supporting 3Gb/s and integrated SW RAID 0/1/10 support
	▪ One 44pin (power + I/O) ATA/100 connector for optical drive support
	▪ One Intel® Remote Management Module (Intel® RMM) connector (Intel® RMM use is optional)
	▪ One Intel® I/O Expansion Module Connector supporting:
	  ▪ Dual GB NIC Intel® I/O Expansion Module (Optional)
	  ▪ External SAS Intel® I/O Expansion Module (Optional)
	  ▪ Infiniband* I/O Expansion Module (Optional)
	▪ SSI-compliant 24-pin control panel header
	▪ SSI-compliant 24-pin main power connector, supporting the ATX-12V standard on the first 20 pins
	▪ 8-Pin +12V Processor Power Connector

Add-in PCI, PCI-X*, PCI Express* Cards	▪ One low profile riser slot supporting 1U or 2U PCIe* riser cards ▪ One full height riser slot supporting 1U or 2U PCI-X* and PCIe* riser cards
On-board Video	ATI* ES1000 video controller with 16MB DDR SDRAM
On-board Hard Drive Controller	▪ Six ESB-2 3Gb/s SATA ports. ▪ Intel® Embedded Server RAID Technology II with SW RAID levels 0/1/10. ▪ Optional support for SW RAID 5 with activation key.[2]
LAN	Two 10/100/1000 Intel® 82563EB PHYs supporting Intel® I/O Acceleration Technology
System Fans	Six 4-pin Fan Headers supporting two processor fans, and four system fans

[1] For the remainder of this document, the Intel® 6321ESB I/O Controller Hub may be refferred to as ESB-2.

[2] Onboard SATA SW RAID 5 support provided as a post-launch product feature.

System Management	Support for Intel® System Management Software

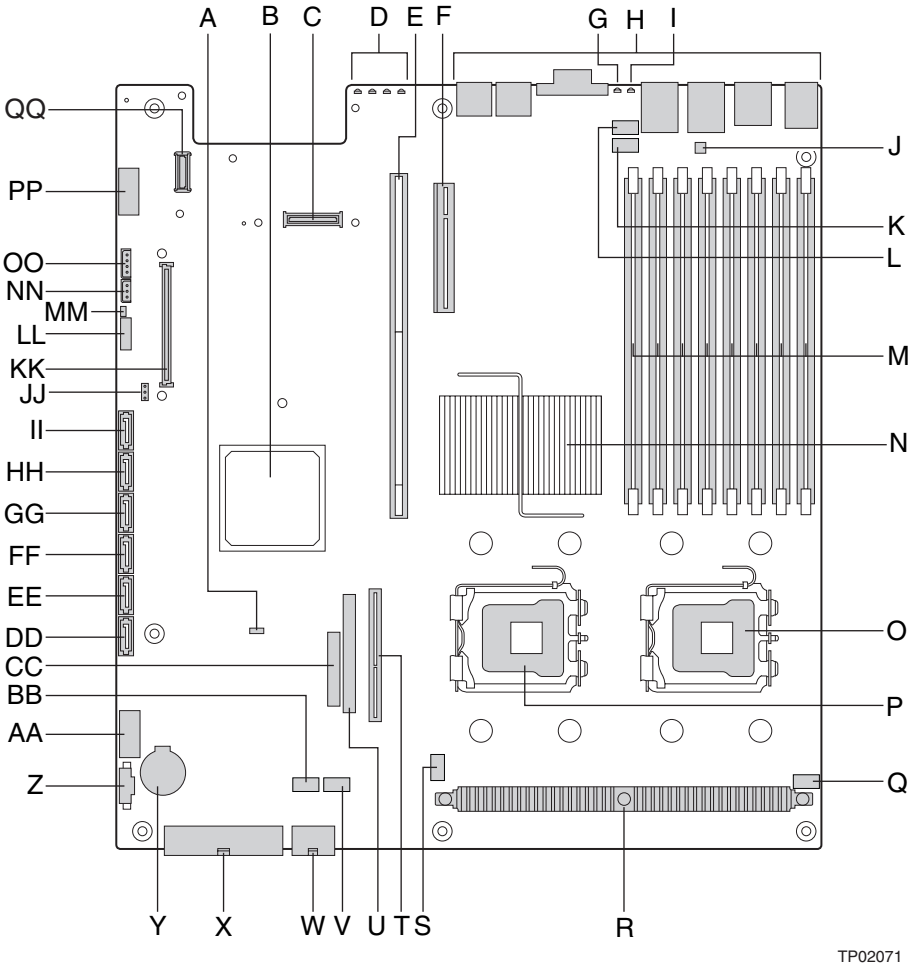


Figure 49. Intel® Server Board S5000PAL

	Description		Description
A	BIOS Bank Select Jumper	V	System Fan #2 Header
B	Intel® 6321ESB I/O Controller Hub	W	CPU Power Connector
C	IO Module Option Connector	X	Main Power Connector
D	POST Code Diagnostic LEDs	Y	Battery
E	Intel® Adaptive Slot – Full Height	Z	Power Supply Management Connector
F	PCI Express* Riser Slot – Low Profile	AA	Dual Port USB 2.0 Header
G	System Identification LED - Blue	BB	System Fan #1 Header
H	External IO Connectors	CC	SSI 24-pin Control Panel Header
I	Status LED – Green / Amber	DD	SATA 0
J	Serial 'B' Port Configuration Jumper	EE	SATA 1
K	System Fan #4 Header	FF	SATA 2
L	System Fan #3 Header	GG	SATA 3
M	FBDIMM Slots	HH	SATA 4
N	Intel® 5000P Memory Controller Hub (MCH) or Intel® 5000X Memory Controller Hub (MCH)	II	SATA 5
O	CPU #1 Connector	JJ	SATA SW RAID 5 Activation Key Connector
P	CPU #2 Connector	KK	Intel® Remote Management Module (RMM) Connector
Q	CPU #1 Fan Header	LL	System Recovery Jumper Block
R	Voltage Regulator Heat Sink	MM	Chassis Intrusion Switch Header
S	CPU #2 Fan Header	NN	3-pin IPMB Header
T	Bridge Board Connector	OO	Intel® Local Control Panel Header
U	ATA-100 Optical Drive Connector (Power+IO)	PP	Serial 'A' Header
		QQ	Intel® RMM NIC Connector

Figure 50. Intel® Server Board S5000PAL Components

9.1.1 Processor Support

The server system supports one or two Dual-Core Intel® Xeon® processors 5000 sequence, with system bus speeds of 667 MHz, 1066 MHz, and 1333 MHz, and core frequencies starting at 2.67 GHz. Previous generations of the Intel® Xeon® processor are not supported on this server board.

Note: Only Dual-Core Intel® Xeon® processors 5000 sequence, that support system bus speeds of 667 MHz, 1066 MHz, and1333 MHz are supported on this server board. See the following table for a list of supported processors.

Dual-Core Intel® Xeon® processors 5000 sequence will encompass the following:

Table 54. Processor Support Matrix

Processor Family	System Bus Speed	Core Frequency	Cache	Watts	Support
Intel® Xeon® Processor	533 MHz	All			No
Intel® Xeon® Processor	800 MHz	All			No
Dual-Core Intel® Xeon® Processor 5030	667 MHz	2.67 GHz	2x 2 MB	95	Yes
Dual-Core Intel® Xeon® Processor 5050	667 MHz	3.0 GHz	2x 2 MB	95	Yes
Dual-Core Intel® Xeon® Processor 5060	1066 MHz	3.2 GHz	2x 2 MB	130	Yes
Dual-Core Intel® Xeon® Processor 5063	1066 MHz	3.2 GHz	2x 2 MB	95	Yes
Dual-Core Intel® Xeon® Processor 5080	1066 MHz	3.73 GHz	2x 2 MB	130	Yes
Dual-Core Intel® Xeon® Processor 51xx	1333/1066 MHz	TBD	TBD	TBD	Yes

9.1.1.1 Processor Population Rules

When two processors are installed, both must be of identical revision, core voltage, and bus/core speed. When only one processor is installed, it must be in the socket labeled CPU1. The other socket must be empty.

The system is designed to provide up to 130A of current per processor. Processors with higher current requirements are not supported.

No terminator is required in the second processor socket when using a single processor configuration.

9.1.1.2 Common Enabling Kit (CEK) Design Support

The server system complies with Intel's Common Enabling Kit (CEK) processor mounting and heat sink retention solution. The server board ships with a CEK spring snapped onto the underside of the server board, beneath each processor socket. The heat sink attaches to the CEK, over the top of the processor and the thermal interface material (TIM). See the figure below for the stacking order of the chassis, CEK spring, server board, TIM, and heat sink.

The CEK spring is removable, allowing for the use of non-Intel heat sink retention solutions.

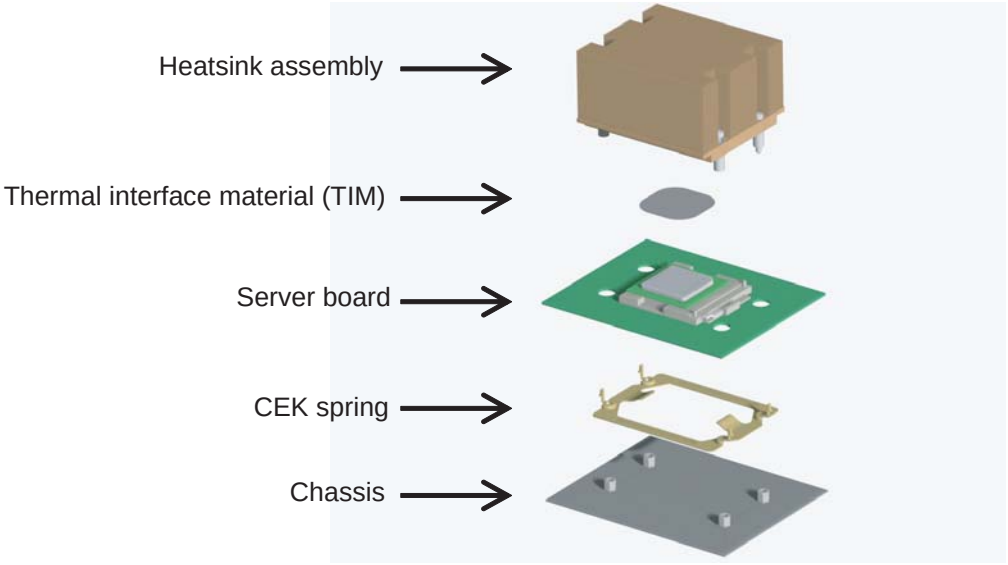


Figure 51. CEK Processor Mounting

10. Environmental and Regulatory Specifications

10.1 System Level Environmental Limits

The table below defines the system level operating and non-operating environmental limits

Table 55. System Environmental Limits Summary

Parameter	Limits
Operating Temperature	+10°C to +35°C with the maximum rate of change not to exceed 10°C per hour
Non-Operating Temperature	-40°C to +70°C
Non-Operating Humidity	90%, non-condensing @ 28°C
Acoustic noise	Sound Pressure: 55 dBA (Rack mount) in an idle state at typical office ambient temperature. (23 +/- degrees C) Sound Power: 7.0 BA in an idle state at typical office ambient temperature. (23 +/- 2 degrees C)
Shock, operating	Half sine, 2 g peak, 11 mSec
Shock, unpackaged	Trapezoidal, 25 g, velocity change 136 inches/sec
Shock, packaged	Non-palletized free fall in height 24 inches (≧40 lbs to < 80 lbs)
Vibration, unpackaged	5 Hz to 500 Hz, 2.20 g RMS random
Shock, operating	Half sine, 2 g peak, 11 mSec
ESD	+/-15kV except I/O port +/-8KV per Intel Environmental test specification
System Cooling Requirement in BTU/Hr	1826 BTU/hour

10.2 Product Regulatory Compliance

10.2.1 Product Safety Compliance

The Intel® Server Chassis SR2500 complies with the following safety requirements:

- UL60950 – CSA 60950(USA / Canada)
- EN60950 (Europe)
- IEC60950 (International)
- CB Certificate & Report, IEC60950 (report to include all country national deviations)
- GS License (Germany)
- Belarus License (Belarus)
- Ukraine License (Ukraine)
- CE - Low Voltage Directive 73/23/EEE (Europe)
- IRAM Certification (Argentina)
- GB4943- CNCA Certification (China)

10.2.2 Product EMC Compliance

The Intel® Server Chassis SR2500 has been tested and verified to comply with the following electromagnetic compatibility (EMC) regulations when installed a compatible Intel host system. For information on compatible host system(s) refer to Intel's Server Builder website or contact your local Intel representative.

- FCC (Class A Verification) – Radiated & Conducted Emissions (USA)
- CISPR 22 – Emissions (International)
- EN55022 - Emissions (Europe)
- EN55024 - Immunity (Europe)
- EN61000-3-2 - Harmonics (Europe)
- EN61000-3-3 - Voltage Flicker (Europe)
- CE – EMC Directive 89/336/EEC (Europe)
- VCCI Emissions (Japan)
- AS/NZS 3548 Emissions (Australia / New Zealand)
- BSMI CNS13438 Emissions (Taiwan)
- Belarus License (Belarus)
- Ukraine License (Ukraine)
- RRL MIC Notice No. 1997-41 (EMC) & 1997-42 (EMI) (Korea)
- GB 9254 - CNCA Certification (China)
- GB 17625 - (Harmonics) CNCA Certification (China)

10.2.3 Product Regulatory Compliance Markings

This product is provided with the following product certification markings.

Regulatory Compliance	Region	Marking
cULus Listing Marks	USA/Canada	
GS Mark	Germany	
CE Mark	Europe	
FCC Marking (Class A)	USA	This device complies with Part 15 of the FCC Rules. Operation of this device is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. Manufactured by Intel Corporation
EMC Marking (Class A)	Canada	CANADA ICES-003 CLASS A CANADA NMB-003 CLASSE A
C-Tick Mark	Australia / New Zealand	
VCCI Marking (Class A)	Japan	この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。VCCI-A
BSMI Certification Number & Class A Warning	Taiwan	
		警告使用者： 這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策
RRL MIC Mark	Korea	
China Compulsory Certification Mark	China	

10.3 Electromagnetic Compatibility Notices

10.3.1 USA

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124
1-800-628-8686

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit other than the one to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment. The customer is responsible for ensuring compliance of the modified product.

Only peripherals (computer input/output devices, terminals, printers, etc.) that comply with FCC Class B limits may be attached to this computer product. Operation with noncompliant peripherals is likely to result in interference to radio and TV reception.

All cables used to connect to peripherals must be shielded and grounded. Operation with cables, connected to peripherals, that are not shielded and grounded may result in interference to radio and TV reception.

10.3.2 FCC Verification Statement

Product Type: Intel® Server Chassis SR2500; Intel® Server Board S5000PAL

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124-6497

Phone: 1 (800)-INTEL4U or 1 (800) 628-8686

10.3.3 ICES-003 (Canada)

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: “Appareils Numériques”, NMB-003 édictée par le Ministre Canadian des Communications.

(English translation of the notice above) This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled “Digital Apparatus,” ICES-003 of the Canadian Department of Communications.

10.3.4 Europe (CE Declaration of Conformity)

This product has been tested in accordance too, and complies with the Low Voltage Directive (73/23/EEC) and EMC Directive (89/336/EEC). The product has been marked with the CE Mark to illustrate its compliance.

10.3.5 Japan EMC Compatibility

Electromagnetic Compatibility Notices (International)

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

English translation of the notice above:

This is a Class A product based on the standard of the Voluntary Control Council For Interference (VCCI) from Information Technology Equipment. If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

10.3.6 BSMI (Taiwan)

The BSMI Certification number and the following warning is located on the product safety label which is located on the bottom side (pedestal orientation) or side (rack mount configuration).

警告使用者：

這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

10.3.7 Korean RRL Compliance

English translation of the notice above:

1. Type of Equipment (Model Name): On License and Product
2. Certification No.: On RRL certificate. Obtain certificate from local Intel representative
3. Name of Certification Recipient: Intel Corporation
4. Date of Manufacturer: Refer to date code on product
5. Manufacturer/Nation: Intel Corporation/Refer to country of origin marked on product

10.3.8 CNCA (CCC-China)

The CCC Certification Marking and EMC warning is located on the outside rear area of the product.

声明

此为A级产品，在生活环境中，该产品可能会造成无线电干扰。在这种情况下，可能需要用户对其干扰采取可行的措施。

10.4 Replacing the Back up Battery

The lithium battery on the server board powers the real time clock (RTC) for up to 10 years in the absence of power. When the battery starts to weaken, it loses voltage, and the server settings stored in CMOS RAM in the RTC (for example, the date and time) may be wrong. Contact your customer service representative or dealer for a list of approved devices.

WARNING

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Discard used batteries according to manufacturer's instructions.

ADVARSEL!

Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

ADVARSEL

Lithiumbatteri - Eksplosjonsfare. Ved utskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

VARNING

Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

VAROITUS

Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

10.5 Serviceability and Availability

The system is designed to be serviced by qualified technical personnel only.

The desired Mean Time To Repair (MTTR) of the system is 30 minutes including diagnosis of the system problem. To meet this goal, the system enclosure and hardware have been designed to minimize the MTTR.

Following are the maximum times that a trained field service technician should take to perform the listed system maintenance procedures, after diagnosis of the system and having identified the failed component.

Activity	Time Estimate
Remove cover	1 min
Remove and replace hard disk drive	5 min
Remove and replace power supply module	1 min
Remove and replace system fan (non-hot swappable)	7 min
Remove and replace system fan (hot swappable)	1 min
Remove and replace backplane board	12 min
Remove and replace midplane board	10 min
Remove and replace control panel module	2 min
Remove and replace server board	15 min

10.6 Restriction of Hazardous Substances (RoHS) Compliance

Intel has a system in place to restrict the use of banned substances in accordance with the European Directive 2002/95/EC. Compliance is based on declaration that materials banned in the RoHS Directive are either (1) below all applicable substance threshold limits or (2) an approved/pending RoHS exemption applies.

Note: RoHS implementing details are not fully defined and may change.

Threshold limits and banned substances are noted below.

- Quantity limit of 0.1% by mass (1000 PPM) for:
  - Lead
  - Mercury
  - Hexavalent Chromium
  - Polybrominated Biphenyls Diphenyl Ethers (PBDE)
- Quantity limit of 0.01% by mass (100 PPM) for:
  - Cadmium

10.7 Regulated Specified Components

To maintain the UL listing and compliance to other regulatory certifications and/or declarations, the following regulated components must be used and conditions adhered to. Interchanging or use of other component will void the UL listing and other product certifications and approvals.

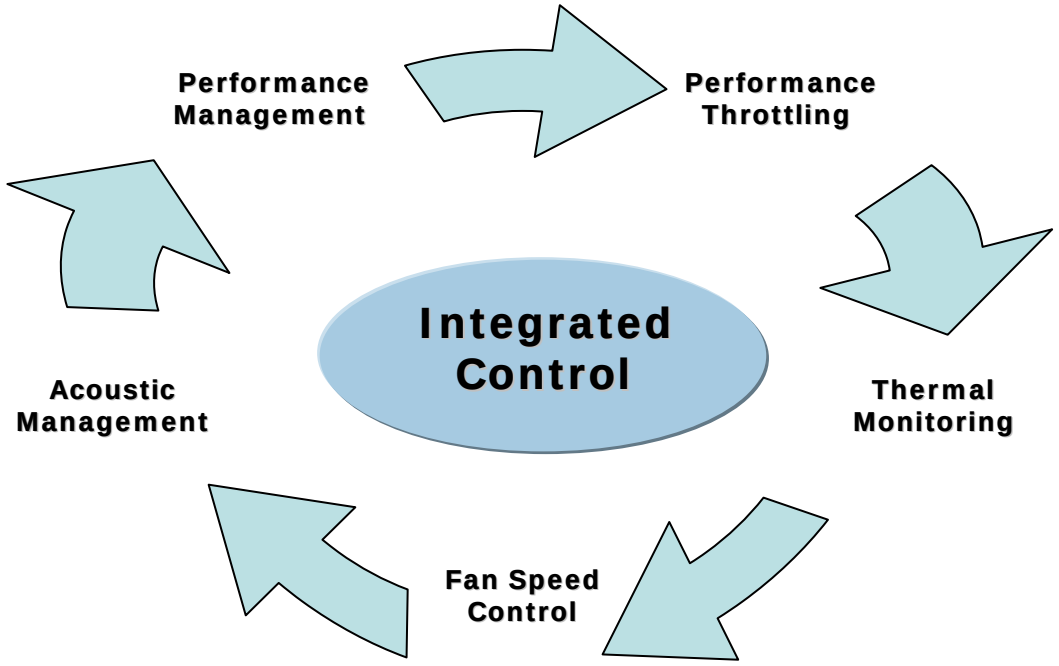
Updated product information for configurations can be found on the Intel Server Builder Web site at the following URL: http://channel.intel.com/go/serverbuilder
If you do not have access to Intel's Web address, please contact your local Intel representative.

- **Server Chassis** (base chassis is provided with power supply and fans)—UL listed.
- **Server board**—you must use an Intel server board—UL recognized.
- **Add-in boards**—must have a printed wiring board flammability rating of minimum UL94V-1. Add-in boards containing external power connectors and/or lithium batteries must be UL recognized or UL listed. Any add-in board containing modem telecommunication circuitry must be UL listed. In addition, the modem must have the appropriate telecommunications, safety, and EMC approvals for the region in which it is sold.

Peripheral Storage Devices—must be UL recognized or UL listed accessory and TUV or VDE licensed. Maximum power rating of any one device is 19 watts. Total server configuration is not to exceed the maximum loading conditions of the power supply.

11. Platform Control

This server platform has embedded platform control which is capable of automatically adjusting system performance and acoustic levels.



11.1 Overview

Platform control optimizes system performance and acoustics levels through:

- Performance Management
- Performance Throttling
- Thermal Monitoring
- Fan Speed Control
- Acoustics Management

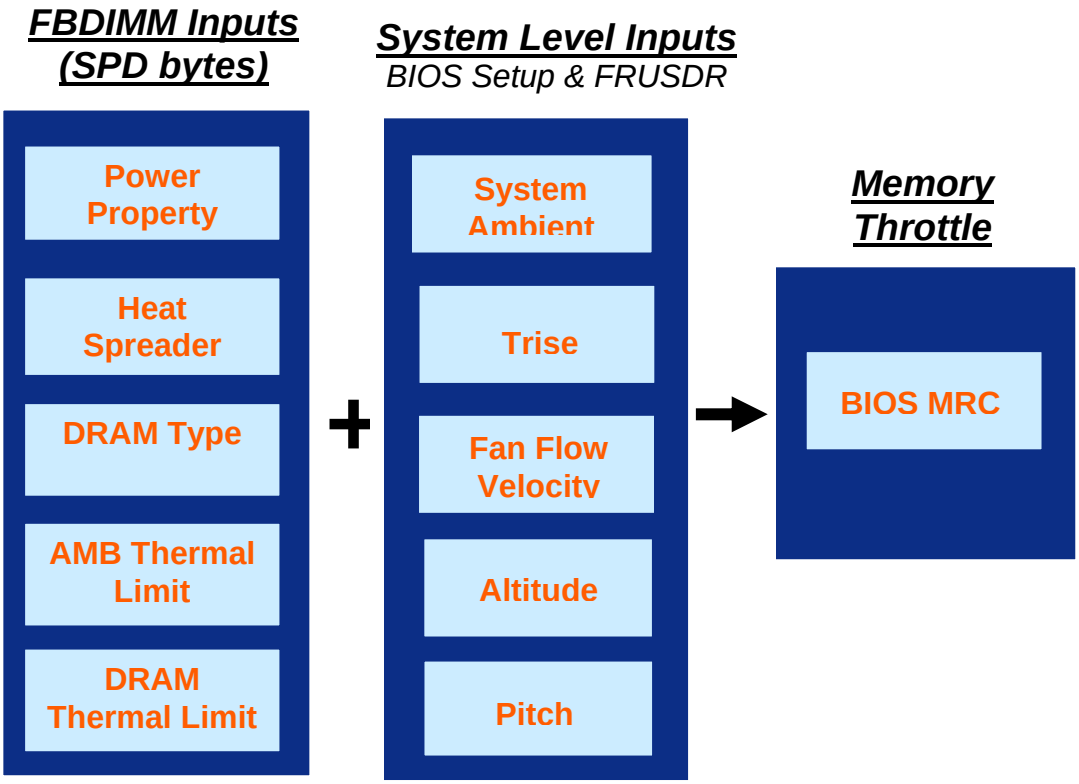
The system components used to implement platform control include:

- Baseboard Management Controller functions of the ESB-2
- LM94 Sensor Monitoring Chip
- Platform Sensors
- Variable Speed System Fans
- System BIOS
- BMC Firmware
- Sensor Data Records as loaded by the FRUSDR Utility
- FBDIMM type
- Processor type

11.2 FBDIMM Open Loop Throughput Throttling

Memory throttling is a feature of the Intel® 5000 Series Chipsets to prevent FBDIMM memory from overheating. If the performance of the installed FB-DIMMs approaches their supported thermal limit for a given platform, the system BIOS will initiate memory throttling which manages memory performance by limiting bandwidth to the DIMMs, therefore capping the power consumption and preventing the DIMMs from overheating. Memory throttling can be minimized by operating your platform in “Performance Mode” (default) which changes the system Fan Control profile to run the system fans at higher speeds. Running the platform in “Acoustics Mode” will cause the system fans to run slower to meet the acoustic limits for the given platform.

System BIOS utilizes a Memory Reference Code (MRC) throttling algorithm to maximize memory bandwidth for a given configuration when memory throttling is initialized. The MRC code relies on Serial Presence Detect (SPD) data read from the installed DIMMs as well as system level data as set through BIOS Setup Options and the FRUSDR Utility.



11.3 Fan Speed Control

System fan speed is controlled by the Baseboard Management Controller (BMC) functions of the ESB-2 chip. During normal system operation, the BMC will retrieve information from BIOS and monitor several platform thermal sensors to determine the required fan speeds.

In order to provide the proper fan speed control for a given system configuration, the BMC must have the appropriate platform data programmed. Platform configuration data is programmed using the FRUSDR Utility during the system integration process and by System BIOS during run time.

11.3.1 System Configuration Using the FRUSDR Utility

The Field Replaceable Unit & Sensor Data Record Update Utility (FRUSDR utility) is a program used to write platform specific configuration data to NVRAM on the server board. It allows the User to select which supported chassis (Intel or Non-Intel) and platform chassis configuration is being used. Based on the input provided, the FRUSDR writes sensor data specific to the configuration to NVRAM for the BMC controller to read each time the system is powered on.

11.3.2 Fan Speed Control from BMC and BIOS Inputs

Using the data programmed to NVRAM by the FRUSDR utility, the BMC is configured to monitor and control the appropriate platform sensors and system fans each time the system is powered on. After power-on, the BMC uses additional data provided to it by System BIOS to determine how the system fans should be controlled.

The BIOS provides data to the BMC telling it which fan profile the platform is setup for, Acoustics Mode or Performance Mode. The BIOS uses the parameters retrieved from the thermal sensor data records (SDR), the fan profile setting from BIOS Setup, and the altitude setting from BIOS Setup to configure the system for memory throttling and fan speed control. If the BIOS fails to get the Thermal SDRs, then it will use the Memory Reference Code (MRC) default settings for the memory throttling settings.

The <F2> BIOS Setup Utility provides options to set the fan profile or operating mode the platform will operate under. Each operating mode has a predefined profile for which specific platform targets are configured, which in turn determines how the system fans operate to meet those targets. Platform profile targets are determined by which type of platform is selected when running the FRUSDR utility and by BIOS settings configured using the <F2> BIOS Setup Utility.

11.3.2.1 Configuring the Fan Profile Using the BIOS Setup Utility

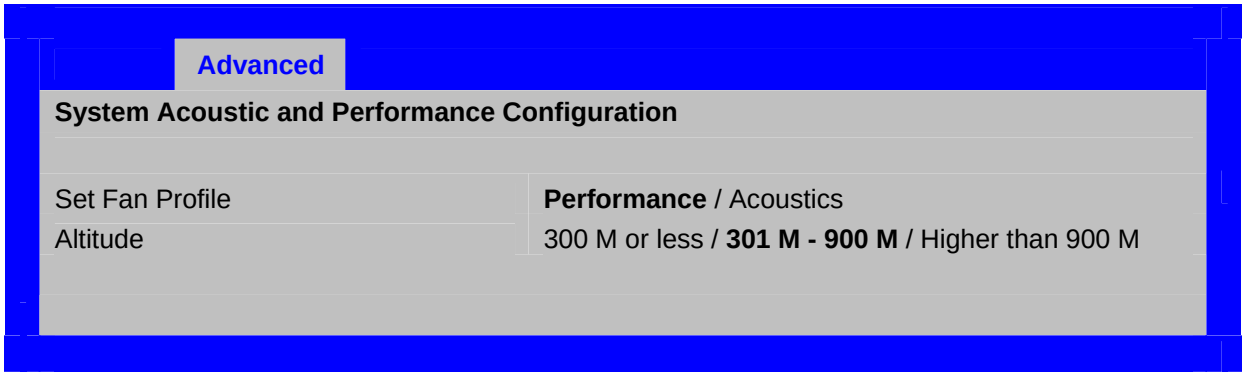
The BIOS uses options set in the <F2> BIOS Setup Utility to determine what fan profile the system should operate under. These options include “SET FAN PROFILE” and “ALTITUDE”.

The “SET FAN PROFILE” option can be set to either the “Performance” mode (Default), or “Acoustics” mode. See the following sections for detail describing the difference between each mode. Changing the fan profile to Acoustics mode may affect system performance.

The “ALTITUDE” option is used to determine appropriate memory performance settings based on the different cooling capability at different altitudes. At high altitude, memory performance must be reduced to compensate for thinner air. Be advised, selecting an Altitude option to a setting that does not meet the operating altitude of the server may limit the system fans ability to provide adequate cooling to the memory. If the air flow is not sufficient to meet the needs of the server even after throttling has occurred, the system may shut down due to excessive platform thermals.

By default, the Altitude option is set to 301Meters – 900 Meters which is believed to cover the majority of the operating altitudes for these server platforms.

The following Diagrams show which BIOS Setup Utility menu is used to configure the desired Fan Profile.


Advanced
System Acoustic and Performance Configuration
Set Fan Profile
Performance / Acoustics
Altitude
300 M or less / 301 M - 900 M / Higher than 900 M

Setup Item	Option	Help Text	Comments
Set Fan Profile	**Performance** Acoustic	Select the fan control profile that will be used to cool the system.	Performance mode favors using fans over throttling memory bandwidth to cool the system.
Altitude	300 M or less **301 M - 900 M** Higher than 900 M	300 M or less (<= 980ft): Provides the best performance option for servers operating at or near sea level. 301 M – 900 M (980ft - 2950ft): Provides the best performance option for servers operating at moderate altitudes above sea level. Higher than 900 M (>2950ft): Provides the best performance option for servers operating at high elevations above sea level.	

Note: Fan speed control for non-Intel chassis, as configured after running the FRUSDR utility and selecting the Non-Intel Chassis option, is limited to only the CPU fans. The BMC only requires the processor thermal sensor data ito determine how fast to operate these fans. The remaining system fans will operate at 100% operating limits due to unknown variables associated with the given chassis and its fans. Therefore, regardless of whether the system is configured for Performance Mode or Acoustics Mode, the System fans will always run at 100% operating levels providing for maximum airflow. In this scenario the Performance and Acoustic mode settings only affects the allowable performance of the memory (higher BW for the Performance mode).

11.3.2.2 Performance Mode (Default)

With the platform running in Performance mode (default), several platform control algorithm variables are set to enhance the platform's capability of operating at maximum performance targets for the given system. In doing so, the platform is programmed with higher fan speeds at lower external temperatures. This will result in a louder acoustic level than is targeted for the given platform, but the increased airflow of this operating mode will greatly reduce possible memory throttling from occurring and will reduce dynamic fan speed changes based on processor utilization.

11.3.2.3 Acoustics Mode

With the platform running in Acoustics mode, several platform control algorithm variables are set to ensure acoustic targets are not exceeded for specified Intel platforms. In this mode, the

platform is programmed to set the fans at lower speeds when the processor does not require additional cooling due to high utilization / power consumption. Memory throttling will be utilized to ensure that the memory thermal limits are not exceeded.

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Appendix A: Chassis Integration and Usage Tips

This appendix provides a list of useful information that is unique to the Intel® Server Chassis SR2500 and should be kept in mind while integrating and configuring your system.

- In a single power supply configuration, the power supply must be placed in the lower slot. A power supply blank must be installed in the upper slot in order to maintain proper airflow in the system.
- Do not mix DIMMs of different heights. For tall DIMMS the DIMM baffle must be removed from the Processor Air Duct for proper fitment. The baffle must be installed for shorter DIMMS to ensure proper airflow and DIMM cooling.
- You must run the FRUSDR utility to load the proper Sensor Data Records for this chassis on to the server board. Failure to do so may result in possible false errors being reported to the System Event Log. It is best to download the latest FRUSDR Utility for your particular server board using the Intel® Server Deployment Toolkit or from the following web site: http://support.intel.com/support/motherboards/server
- To ensure proper cooling of your server, all air baffles and air ducts must be in place. In addition, all drive bays must be populated with either a drive or a drive blank and both power supply slots must be populated by either a power supply or a power supply blank.
- Processor fans are not supported and are not needed in the Intel® Server Chassis SR2500.
- The Mid-plane board must be removed from the system before removal of the Backplane.
- In order to remove or replace the Mid-plane board, the fan cage must first be removed.
- There are three indentations in the top of the chassis. These are for the Intel Safety Label, the Windows Certification Label, and a Customer Defined Label.

Appendix B: POST Code Diagnostic LED Decoder

During the system boot process, BIOS executes a number of platform configuration processes, each of which is assigned a specific hex POST code number. As each configuration routine is started, BIOS will display the given POST code to the POST Code Diagnostic LEDs found on the back edge of the server board. To assist in troubleshooting a system hang during the POST process, the Diagnostic LEDs can be used to identify the last POST process to be executed.

Each POST code will be represented by a combination of colors from the four LEDs. The LEDs are capable of displaying three colors: green, red, and amber. The POST codes are divided into two nibbles, an upper nibble and a lower nibble. Each bit in the upper nibble is represented by a red LED and each bit in the lower nibble is represented by a green LED. If both bits are set in the upper and lower nibbles then both red and green LEDs are lit, resulting in an amber color. If both bits are clear, then the LED is off.

In the below example, BIOS sends a value of ACh to the diagnostic LED decoder. The LEDs are decoded as follows:

- red bits = 1010b = Ah
- green bits = 1100b = Ch

Since the red bits correspond to the upper nibble and the green bits correspond to the lower nibble, the two are concatenated to be ACh.

Table 56: POST Progress Code LED Example

	8h		4h		2h		1h	
LEDs	**Red**	**Green**	**Red**	**Green**	**Red**	**Green**	**Red**	**Green**
ACh	1	1	0	1	1	0	0	0
Result	Amber		Green		Red		Off	
	MSB						LSB	

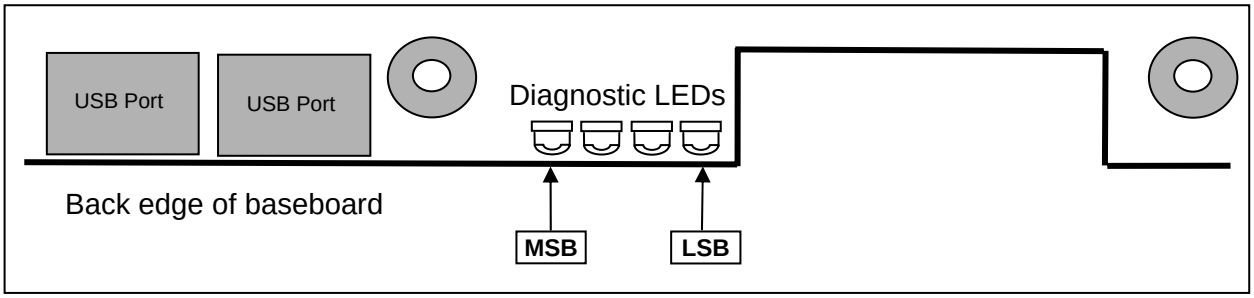

Figure 52. Diagnostic LED Placement Diagram

Table 57. Diagnostic LED POST Code Decoder

Checkpoint	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	MSB			LSB	
Host Processor					
0x10h	OFF	OFF	OFF	R	Power-on initialization of the host processor (bootstrap processor)
0x11h	OFF	OFF	OFF	A	Host processor cache initialization (including AP)
0x12h	OFF	OFF	G	R	Starting application processor initialization
0x13h	OFF	OFF	G	A	SMM initialization
Chipset					
0x21h	OFF	OFF	R	G	Initializing a chipset component
Memory					
0x22h	OFF	OFF	A	OFF	Reading configuration data from memory (SPD on DIMM)
0x23h	OFF	OFF	A	G	Detecting presence of memory
0x24h	OFF	G	R	OFF	Programming timing parameters in the memory controller
0x25h	OFF	G	R	G	Configuring memory parameters in the memory controller
0x26h	OFF	G	A	OFF	Optimizing memory controller settings
0x27h	OFF	G	A	G	Initializing memory, such as ECC init
0x28h	G	OFF	R	OFF	Testing memory
PCI Bus					
0x50h	OFF	R	OFF	R	Enumerating PCI busses
0x51h	OFF	R	OFF	A	Allocating resources to PCI busses
0x52h	OFF	R	G	R	Hot Plug PCI controller initialization
0x53h	OFF	R	G	A	Reserved for PCI bus
0x54h	OFF	A	OFF	R	Reserved for PCI bus
0x55h	OFF	A	OFF	A	Reserved for PCI bus
0x56h	OFF	A	G	R	Reserved for PCI bus
0x57h	OFF	A	G	A	Reserved for PCI bus
USB					
0x58h	G	R	OFF	R	Resetting USB bus
0x59h	G	R	OFF	A	Reserved for USB devices
ATA / ATAPI / SATA					
0x5Ah	G	R	G	R	Resetting PATA / SATA bus and all devices
0x5Bh	G	R	G	A	Reserved for ATA
SMBUS					
0x5Ch	G	A	OFF	R	Resetting SMBUS
0x5Dh	G	A	OFF	A	Reserved for SMBUS
Local Console					
0x70h	OFF	R	R	R	Resetting the video controller (VGA)
0x71h	OFF	R	R	A	Disabling the video controller (VGA)
0x72h	OFF	R	A	R	Enabling the video controller (VGA)
Remote Console					
0x78h	G	R	R	R	Resetting the console controller
0x79h	G	R	R	A	Disabling the console controller
0x7Ah	G	R	A	R	Enabling the console controller
Keyboard (PS2 or USB)					
0x90h	R	OFF	OFF	R	Resetting the keyboard
0x91h	R	OFF	OFF	A	Disabling the keyboard

Checkpoint	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	MSB			LSB	
0x92h	R	OFF	G	R	Detecting the presence of the keyboard
0x93h	R	OFF	G	A	Enabling the keyboard
0x94h	R	G	OFF	R	Clearing keyboard input buffer
0x95h	R	G	OFF	A	Instructing keyboard controller to run Self Test (PS2 only)
Mouse (PS2 or USB)					
0x98h	A	OFF	OFF	R	Resetting the mouse
0x99h	A	OFF	OFF	A	Detecting the mouse
0x9Ah	A	OFF	G	R	Detecting the presence of mouse
0x9Bh	A	OFF	G	A	Enabling the mouse
Fixed Media					
0xB0h	R	OFF	R	R	Resetting fixed media device
0xB1h	R	OFF	R	A	Disabling fixed media device
0xB2h	R	OFF	A	R	Detecting presence of a fixed media device (IDE hard drive detection, etc.)
0xB3h	R	OFF	A	A	Enabling / configuring a fixed media device
Removable Media					
0xB8h	A	OFF	R	R	Resetting removable media device
0xB9h	A	OFF	R	A	Disabling removable media device
0xBAh	A	OFF	A	R	Detecting presence of a removable media device (IDE CDROM detection, etc.)
0xBCh	A	G	R	R	Enabling / configuring a removable media device
Boot Device Selection					
0xD0	R	R	OFF	R	Trying boot device selection
0xD1	R	R	OFF	A	Trying boot device selection
0xD2	R	R	G	R	Trying boot device selection
0xD3	R	R	G	A	Trying boot device selection
0xD4	R	A	OFF	R	Trying boot device selection
0xD5	R	A	OFF	A	Trying boot device selection
0xD6	R	A	G	R	Trying boot device selection
0xD7	R	A	G	A	Trying boot device selection
0xD8	A	R	OFF	R	Trying boot device selection
0xD9	A	R	OFF	A	Trying boot device selection
0XDA	A	R	G	R	Trying boot device selection
0xDB	A	R	G	A	Trying boot device selection
0xDC	A	A	OFF	R	Trying boot device selection
0xDE	A	A	G	R	Trying boot device selection
0xDF	A	A	G	A	Trying boot device selection
Pre-EFI Initialization (PEI) Core					
0xE0h	R	R	R	OFF	Started dispatching early initialization modules (PEIM)
0xE2h	R	R	A	OFF	Initial memory found, configured, and installed correctly
0xE1h	R	R	R	G	Reserved for initialization module use (PEIM)
0xE3h	R	R	A	G	Reserved for initialization module use (PEIM)
Driver Execution Environment (DXE) Core					
0xE4h	R	A	R	OFF	Entered EFI driver execution phase (DXE)
0xE5h	R	A	R	G	Started dispatching drivers
0xE6h	R	A	A	OFF	Started connecting drivers
DXE Drivers					
0xE7h	R	A	A	G	Waiting for user input

Checkpoint	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	MSB			**LSB**	
0xE8h	A	R	R	OFF	Checking password
0xE9h	A	R	R	G	Entering BIOS setup
0xEAh	A	R	A	OFF	Flash Update
0xEEh	A	A	A	OFF	Calling Int 19. One beep unless silent boot is enabled.
0xEFh	A	A	A	G	Unrecoverable boot failure / S3 resume failure
Runtime Phase / EFI Operating System Boot					
0xF4h	R	A	R	R	Entering Sleep state
0xF5h	R	A	R	A	Exiting Sleep state
0xF8h	A	R	R	R	Operating system has requested EFI to close boot services (ExitBootServices ( ) has been called)
0xF9h	A	R	R	A	Operating system has switched to virtual address mode (SetVirtualAddressMap ( ) has been called)
0xFAh	A	R	A	R	Operating system has requested the system to reset (ResetSystem () has been called)
Pre-EFI Initialization Module (PEIM) / Recovery					
0x30h	OFF	OFF	R	R	Crisis recovery has been initiated because of a user request
0x31h	OFF	OFF	R	A	Crisis recovery has been initiated by software (corrupt flash)
0x34h	OFF	G	R	R	Loading crisis recovery capsule
0x35h	OFF	G	R	A	Handing off control to the crisis recovery capsule
0x3Fh	G	G	A	A	Unable to complete crisis recovery.

Appendix C: POST Error Beep Codes

The following table lists POST error beep codes. Prior to system Video initialization, BIOS uses these beep codes to inform users on error conditions. The beep code is followed by a user visible code on POST Progress LEDs.

Table 58. POST Error Beep Codes

Beeps	Error Message	POST Progress Code	Description
3	Memory error		System halted because a fatal error related to the memory was detected.
6	BIOS rolling back error		The system has detected a corrupted BIOS in the flash part, and is rolling back to the last good BIOS.

The BMC may generate beep codes upon detection of failure conditions. Beep codes are sounded each time the problem is discovered, such as on each power-up attempt, but are not sounded continuously. Codes that are common across all Intel® server boards and systems that use the Intel® 5000 Series Chipsets are listed in Table 59. Each digit in the code is represented by a sequence of beeps whose count is equal to the digit.

Table 59. BMC Beep Codes

Code	Reason for Beep	Associated Sensors	Supported?
1-5-2-1	CPU: Empty slot / population error – Processor slot 1 is not populated.	CPU Population Error	Yes
1-5-2-2	CPU: No processors (terminators only)	N/A	No
1-5-2-3	CPU: Configuration error (e.g., VID mismatch)	N/A	No
1-5-2-4	CPU: Configuration error (e.g., BSEL mismatch)	N/A	No
1-5-4-2	Power fault: DC power unexpectedly lost (power good dropout)	Power Unit – power unit failure offset	Yes
1-5-4-3	Chipset control failure	N/A	No
1-5-4-4	Power control fault	Power Unit – soft power control failure offset	Yes

Glossary

Word / Acronym	Definition
ACA	Australian Communication Authority
ANSI	American National Standards Institute
BMC	Baseboard Management Controller
CMOS	Complementary Metal Oxide Silicon
D2D	DC-to-DC
EMP	Emergency Management Port
FP	Front Panel
FRB	Fault Resilient Boot
FRU	Field Replaceable Unit
LCD	Liquid Crystal Display
LPC	Low-Pin Count
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair
OTP	Over-temperature Protection
OVP	Over-voltage Protection
PFC	Power Factor Correction
PSU	Power Supply Unit
RI	Ring Indicate
SCA	Single Connector Attachment
SDR	Sensor Data Record
SE	Single-Ended
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
VCCI	Voluntary Control Council for Interference

Reference Documents

See the following documents for additional information:

- Intel® Server Board S5000PAL Technical Product Specification
- Intel® 5000 Series Chipsets Server Board Family Datasheet
- Intel® Server Chassis SR2500 Power Distribution Board for 750W Power Supply Specification
- Intel® Server Chassis SR2500 750 Watt AC Power Supply Module Specification
- Intel® Server Board S5000PAL/S5000XAL Tested Hardware and OS List